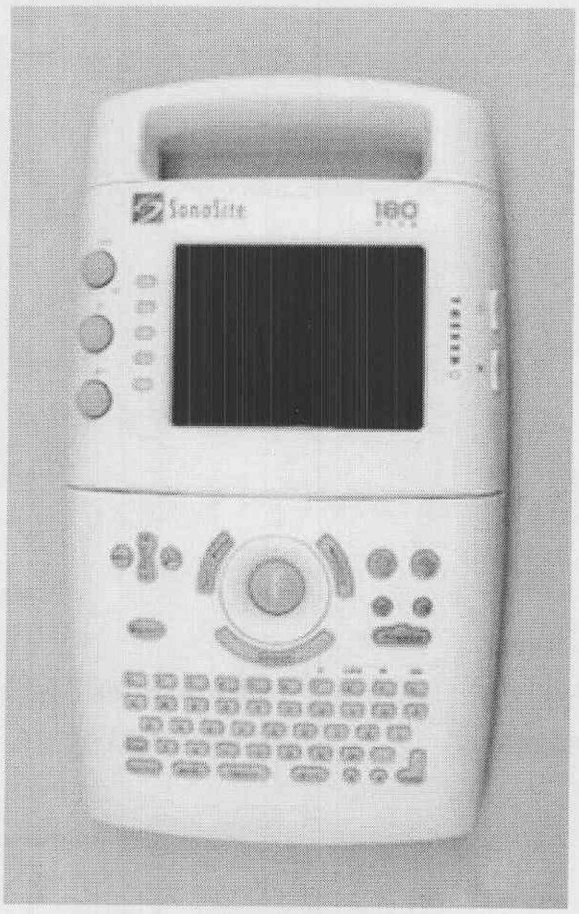
SonoSite™

Ultrasound System PLUS
Service Manual


SonoSite
180
PLUS

P02287-01 7/01

Copyright © 2001 by SonoSite, Inc.

All rights reserved.

Printed in the USA.

Manufactured by
SonoSite, Inc.
21919 30th Drive SE
Bothell, WA, USA 98021-3904
Telephone: 1-888-482-9449 or +1-425-951-1200
Fax: +1-425-951-1201

SonoSite European Headquarters
Baystrait House, Station Road
Biggleswade SG18 8AL
UK
Telephone: +44-1767-313-117
Fax: +44-1767-312-400

SonoSite Asian Headquarters
SonoSite China Limited
Unit C, 8F, One Capital Place
18 Luard Road, Wanchai, Hong Kong
Telephone: +852-2529-2881
Fax: +852-2529-5881

CAUTION:

➤ United States federal law restricts this device to sale by or on the order of a physician.

"PowerMap," "SiteCharge," "SitePack," "SiteStand," and "SonoHeart," are trademarks of SonoSite, Inc.

Non-SonoSite product names may be trademarks or registered trademarks of their respective owners.

SonoSite products may be covered by one or more of the following U.S. patents: 4454884, 4462408, 4469106, 4474184, 4475376, 4515017, 4534357, 4542653, 4543960, 4552607, 4561807, 4566035, 4567895, 4581636, 4591355, 4603702, (4607642), 4644795, 4670339, 4773140, 4817618, 4883059, 4887306, 5016641, 5050610, 5095910, 5099847, 5123415, 5158088, 5197477, 5207225, 5215094, 5226420, 5226422, 5233994, 5255682, (5275167), 5287753, 5305756, 5353354, 5365929, 5381795, 5386830, 5390674, 5402793, (5,423,220), 5438994, 5450851, 5456257, 5471989, 5471990, 5474073, 5476097, 5479930, 5482045, 5482047, 5485842, 5492134, 5517994, 5529070, 5546946, 5555887, 5603323, 5606972, 5617863, (5634465), 5634466, 5636631, 5645066, 5648942, 5669385, (5706819), 5715823, 5718229, 5720291, 5722412, 5752517, 5762067, 5782769, 5800356, 5817024, 5833613, 5846200, 5860924, 5893363, 5916168, 5951478, 6036643, 6102863, 6104126, 6113547, 6117085, 6142946, 6203498 B1, D0280762, D0285484, D0286325, D0300241, D0306343, D0328095, D0369307, D0379231. Other patents pending.

Table of Contents

CHAPTER 1 **Introduction** 1

1.1 About the System 1
1.2 Audience 2
1.3 Conventions Used in This Manual 2
1.4 About the System Software 2
1.5 Software Licensing 3

CHAPTER 2 **Safety** 5

2.1 Electrical Safety 5
  2.1.1 Equipment Protection 7
2.2 Battery Safety 8
2.3 Biological Safety 9
2.4 Labeling Symbols 9

CHAPTER 3 **System Overview** 11

3.1 Theory of Operation 11
  3.1.1 Transducer 12
  3.1.2 Acquisition Subsystem 12
  3.1.3 Processing Subsystem 12
  3.1.4 Display Subsystem 12
  3.1.5 Control Subsystem 12
  3.1.6 User Interface Subsystem 12
  3.1.7 Power Subsystem 13
3.2 Components 13
3.3 Controls 14
3.4 Accessories 15
  3.4.1 Battery Pack 15
    3.4.1.1 Battery Charge Indicators 16
  3.4.2 External Power 16
    3.4.2.1 External System Connections 17
  3.4.3 Power Adapter 17
3.5 System Specifications 18
  3.5.1 Physical Dimensions 18
  3.5.2 Monitor 18
  3.5.3 Transducers 18
  3.5.4 Imaging Modes 19

3.5.5 Image Storage ... 19
3.5.6 Temperature, Pressure, and Humidity Limits ... 19
3.5.6.1 System Operating ... 19
3.5.6.2 System Shipping/Storage ... 19
3.5.6.3 Battery Operating ... 19
3.5.6.4 Battery Shipping/Storage ... 19
3.5.6.5 Transducers Operating ... 19
3.5.6.6 Transducers Shipping/Storage ... 19
3.5.7 Electrical ... 20
3.6 Battery ... 20
3.7 Safety Requirements ... 20
3.7.1 Meets Electromechanical Safety Standards ... 20
3.7.2 Meets EMC/EMI Standards ... 21
3.7.3 Meets Airborne Equipment Standards (without ECG Cable Attached) ... 21
3.7.4 Meets ECG Standard ... 21

CHAPTER 4 Setup and Operation 23
4.1 Connecting and Removing Transducers ... 23
4.2 Turning the System On and Off ... 24
4.3 Installing and Removing the Battery ... 25
4.4 Using AC Power ... 26
4.5 Upgrading the System Software ... 27
4.6 Obtaining A License Key ... 28
4.6.1 Installing A License Key ... 28
4.6.1.1 Displaying the System Information Screen ... 30
4.7 Checking and Charging the Battery ... 30

CHAPTER 5 Cleaning and Disinfecting 33
5.1 Universal Precautions ... 33
5.2 Receipt of Suspected Contaminated Materials ... 33
5.3 Recommended Disinfectants ... 34

CHAPTER 6 Troubleshooting 35
6.1 System and Subsystem Diagnosis ... 35
6.2 System Repair ... 35
6.3 Test Equipment ... 35
6.4 Failures ... 36

6.4.1 Display....36
6.4.2 Control Panel....36
6.4.3 Trackball....36
6.4.4 Main PCBA....36
6.4.5 Clearing the Main PCBA Failure....37
6.4.6 Battery....37

CHAPTER 7 Replacement Procedures 45

7.1 Display Subassembly Replacement....45
7.1.1 Required Parts....45
7.1.2 Required Tools and Materials....45
7.1.3 Removing the Display Subassembly....46
7.1.4 Replacing the Display Subassembly....48
7.2 Control Panel Subassembly Replacement....50
7.2.1 Required Parts....50
7.2.2 Required Tools....50
7.2.3 Removing the Control Panel Subassembly....51
7.2.4 Replacing the Control Panel Subassembly....53
7.3 Trackball....54
7.3.1 Required Parts....54
7.3.2 Required Tools....54
7.3.3 Removing the Trackball....54
7.3.4 Replacing the Trackball....57
7.4 Main PCBA Subassembly Replacement....59
7.4.1 Required Parts....59
7.4.2 Required Tools....60
7.4.3 Removing the Main PCBA Subassembly....60
7.4.4 Replacing the Main PCBA Subassembly....61
7.5 Transducers....64
7.6 AC Power Adapter....64
7.7 OEM Peripherals....65
7.7.1 External Monitor (Sony)....65
7.7.2 VCR (Sony)....65
7.7.3 Printer (Sony)....65

CHAPTER 8 Performance Tests 67

8.1 Overview....67
8.2 Test Equipment:....67
8.3 Setting Up Performance Tests....68
8.3.1 Scan Reference Orientation....68

8.4 Testing 2D Performance 68
  8.4.1 2D Image Quality 68
  8.4.2 Axial Measurement Accuracy 69
  8.4.3 Lateral Measurement Accuracy 69
  8.4.4 Penetration 70
8.5 Additional Performance Tests 70
  8.5.1 CPD 70
  8.5.2 PowerMap DCPD 71
  8.5.3 M-mode Imaging 71
  8.5.4 Tissue Harmonic Imaging 72
  8.5.5 Pulsed Wave (PW) Doppler Imaging 72
  8.5.6 ECG Monitoring 72
  8.5.7 Image Quality Verification Test 73
  8.5.8 Image Review 73
  8.5.9 Printer 73
  8.5.10 Battery Charging 73
  8.5.11 Video Output 73
8.6 Returning Products to SonoSite 74
  8.6.1 Contacting SonoSite Technical Support 74
  8.6.2 Shipping Instructions 74

APPENDIX A **Parts List** 75

APPENDIX B **Service Event Report** 87

Index 89

CHAPTER 1 Introduction

Before servicing the SonoSite ultrasound system, please read the information in this manual. This text applies to SonoSite ultrasound system products manufactured after April 27, 2001. Please find service information about products manufactured before April 27, 2001 in *SonoSite Ultrasound System Service Manual (P00715-02)* and *SonoSite Ultrasound System C1.75 Service Manual (P01118-01)*.

1.1 About the System

The SonoSite system has various configurations and features. All are described in this manual but not every option may apply to your system. System features are dependent on your system configuration, transducer and exam type.

The SonoSite system is a portable, software-controlled, ultrasound system. It has an all-digital architecture. It is used to acquire and display high-resolution, real-time, 2D, Color Power Doppler (CPD), PowerMap™ (PM) Directional Color Power Doppler (DCPD), Tissue Harmonic Imaging (THI), M-mode and Pulsed Wave (PW) Doppler ultrasound images. The system has electrocardiography (ECG), cine review, image zoom, labeling, biopsy, measurements and calculations, serial port connection for image transfer, image storage and review, printing and recording capabilities. The system setup also has a selection to support optical character recognition (OCR) of the English character set for time, date, patient name, and patient identification. The OCR screen characters are optimized for use with the ALI NewPORT DICOM image capture station peripheral available from ALI. For more information about the ALI NewPORT 2.1, refer to the *ALI NewPORT 2.1 Image Capture Station User's Guide*.

Currently, the system supports the following broadband transducers:

- C60/5-2 MHz 60-mm curved array
- C15/4-2 MHz 15-mm micro-curved array
- C11/7-4 MHz 11-mm micro-curved array
- ICT/7-4 MHz 11-mm intracavitary
- L38/10-5 MHz 38-mm linear array

System accessories include a SiteStand® mobile docking station and accessories, SiteCharge™ dual battery charger, a power adapter, a battery, ECG cable, video and printer cables, SiteLink image manager software, SiteStand® basket, Basic Stand, CRT Stand, ScanPack quick access carrier, and SitePack™ protective carry pack.

System peripherals include medical grade (conforming to the requirements of EN60601-1) and non-medical (commercial) grade products. System medical grade peripherals include an external color monitor, video printers, and VCRs. System non-medical grade peripherals include a digital video recorder, a battery charger, a lithium-ion battery, printer, and a handheld monitor. Use of peripherals is covered in the manufacturers' instructions, which accompany each peripheral. System setup instructions for the use of peripherals are covered in Chapter 3 in the *SonoSite Ultasound System User Guide*.

1.2 Audience

The intended audience of this manual is properly trained field and in-house service personnel.

1.3 Conventions Used in This Manual

These conventions are used in this user guide:

- Warnings and cautions are identified with the arrow symbol.
- Control names and references to display elements are presented in **bold-face** type.
- Operating instructions are introduced with a statement in **bold-face** type that ends with a colon. For example: **To read this user guide:**
- When the steps in the operating instructions must be performed in a specific order, the steps are numbered.
- Bulleted lists present information in list format, but they do not imply a sequence.
- Screen display text is shown in Arial 10 pt. For example: Successful upgrade.
- The left side of the system is to your left as you face the system. The system handle is at the top of the system, the battery compartment is at the bottom of the system.
- *Note: A note cites information that is a general rule for a procedure, gives an exception to a rule, or provides noncritical information of general interest.*

1.4 About the System Software

Your SonoSite system contains software that controls its operation. From time to time, SonoSite may provide new software for use with your system. This software is provided using a software update module or a transducer. This software may be either required or optional. A single module or transducer can be used to update one or more systems.

When the new software is required, you must install it if you wish to use the new software features (e.g., new transducer). If you choose not to install it, you must remove the transducer and replace it with one that is compatible with the software that is currently installed in your system.

When the software is optional, you can either install it or choose to use your existing software. If you choose not to install the software, the system will prompt you again whenever the system is started, and whenever the transducer is disconnected and then reconnected to the system. For more information on software upgrades, refer to **Chapter 4.5,** ***Upgrading the System Software,*** on page 27.

1.5 Software Licensing

Use of the software that you receive from SonoSite is controlled by a license key. A license key is a number sequence containing exactly 12 decimal digits.

License keys are obtained from SonoSite or from its authorized representatives. You must obtain one key for each system that will use the new software. See **Chapter 4.6,** ***Obtaining A License Key,*** on page 28 for information on obtaining a license key.

Software that you receive from SonoSite may be installed and will operate for a short period of time without requiring a valid license key. We refer to this period of time as the "grace period." The grace period is variable.

When you first install your software, your SonoSite system will prompt you for a license key. If you have not yet obtained a valid license key, you can elect to use the software as long as the grace period time has not been fully consumed. We refer to this mode of operation as "running in the grace period."

When a system is running in the grace period, all system functions are available. As you use the system, the grace period is slowly consumed. When the grace period has expired, the system will not be usable until a valid license key has been entered. Grace period time is not consumed while the system is powered off or when it is in "sleep" mode. Whenever a system is running in the grace period, the grace period time remaining is available on the license update screen. Refer to **Chapter 4.6.1.1,** ***Displaying the System Information Screen,*** on page 30.

CAUTION:

- When the grace period expires, all system functions except for licensing will be unavailable until you enter a valid license key into the system.

This page intentionally left blank.

CHAPTER 2 Safety

Please read this information before using the SonoSite ultrasound system. It applies to the ultrasound system, transducers, accessories, and peripherals.

A ***WARNING*** describes precautions necessary to prevent injury or loss of life.

A ***CAUTION*** describes precautions necessary to protect the products.

2.1 Electrical Safety

This system meets EN60601-1, Class I/internally-powered equipment requirements and Type BF isolated patient-applied parts safety requirements. The ECG cable meets safety requirements of EN 60601-2-25 for Type CF patient-applied part.

This system complies with the applicable medical equipment requirements published in the Canadian Standards Association (CSA), European Norm Harmonized Standard, and Underwriters Laboratories (UL) safety standards. See **Chapter 3.5, *System Specifications,*** on page 18.

For maximum safety observe the following warnings and cautions:

WARNINGS:

- To avoid discomfort or minor risk of patient injury, keep hot surfaces away from the patient.
- Under certain circumstances, the transducer connector and back of the display enclosure can reach temperatures that exceed EN60601-1 limits for patient contact, therefore only the operator shall handle the system. This does not include the transducer face.
- To avoid discomfort or minor risk of operator injury when handling the transducer connector, the system should not be operated for more than 60 minutes continuously in a live-scan mode (as opposed to freeze or sleep modes).

- To avoid the risk of electrical shock or injury, do not open the system enclosures. All internal adjustments and replacements, except battery replacement, must be made by a qualified technician.
- To avoid the risk of injury, do not operate the system in the presence of flammable gasses or anesthetics. Explosion can result.
- To avoid the risk of electrical shock, use only properly grounded equipment. Shock hazards exist if the AC power adapter is not properly grounded. Grounding reliability can only be achieved when equipment is connected to a receptacle marked "Hospital Only" or "Hospital Grade" or the equivalent. The grounding wire must not be removed or defeated.
- To avoid the risk of electrical shock, before using the transducer, inspect the transducer face, housing, and cable. Do not use the transducer, if the transducer or cable is damaged.
- To avoid the risk of electrical shock, always disconnect the AC power adapter from the system before cleaning the system.
- To avoid the risk of electrical shock, do not use any transducer that has been immersed beyond the specified cleaning or disinfection level. See **Chapter 5, *Cleaning and Disinfecting,*** on page 33.
- To avoid the risk of electrical shock and fire hazard, inspect the AC power adapter cord and plug on a regular basis. Ensure they are not damaged.
- To avoid the risk of electrical shock, use only accessories and peripherals recommended by SonoSite. Connection of accessories and peripherals not recommended by SonoSite could result in electrical shock. Contact SonoSite or your local representative for a list of accessories and peripherals available from or recommend by SonoSite.
- To avoid the risk of electrical shock, use commercial grade peripherals recommended by SonoSite on battery power only. Do not connect these products to AC mains power when using the system to scan or diagnose a patient/subject. Contact SonoSite or your local representative for a list of the commercial grade peripherals available from or recommended by SonoSite.
- To prevent injury, only use market cleared ECG electrodes and cables.
- To avoid the risk of electrical shock to the patient/subject, ensure proper assembly of the ECG electrodes and cables.
- To avoid the risk of electrical shock to the patient/subject, do not touch the system battery contacts while simultaneously touching a patient/subject.
- To prevent injury to the operator/bystander, the transducer must be removed from patient contact before the application of a high-voltage defibrillation pulse.

CAUTIONS:

- Although your system has been manufactured in compliance with existing EMC/EMI requirements (EN60601-1-2), use of the system in the presence of an electromagnetic field can cause degradation of the ultrasound image. If this occurs often, SonoSite suggests a review of the system environment. Identify and remove the possible sources of the emissions or move your system.
- Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. Static shock is a discharge of the electrical energy from a charged body to a lesser or non-charged body. The degree of discharge can

be significant enough to cause damage to a transducer or an ultrasound system. The following precautions can help reduce ESD: anti-static spray on carpets, anti-static spray on linoleum, and anti-static mats.

- Do not use the system if an error message appears on the image display: note the error code; call SonoSite or your local representative; turn off the system by pressing and holding the power switch until the system powers down.
- To avoid increasing the system and transducer connector temperature, do not block the airflow to the ventilation holes on the back of the system.

2.1.1 Equipment Protection

To protect your ultrasound system, transducer, and accessories, follow these precautions.

To protect your ultrasound system, transducer, and accessories, follow these precautions.

CAUTIONS:

- The ECG cable emits electromagnetic interference when connected to the SonoSite system. It is not approved for use in-flight on aircraft.
- Excessive bending or twisting of cables can cause a failure or intermittent operation.
- Improper cleaning or disinfecting of any part of the system can cause permanent damage. For cleaning and disinfecting instructions, see **Chapter 5, *Cleaning and Disinfecting,*** on page 33.
- Do not submerge the transducer connector in solution. The cable is not liquid-tight beyond the transducer connector/cable interface.
- Do not use solvents such as thinner or benzene, or abrasive cleaners on any part of the system.
- Remove the battery from the system if the system is not likely to be used for some time.
- Do not spill liquid on the system.
- The top membrane of the phantom is delicate and can be damaged if handled improperly. Use minimum force when coupling the transducer to the phantom.
- Do not handle PCBs without proper static protection. Improper handling may damage components.
- Incorrect assembly or configuration or using an improper power source may damage the system.
- Do not touch the scanhead connector pins.

2.2 Battery Safety

To avoid the risk of injury, follow the warnings and cautions to make sure that the battery does not burst, ignite, or generate heat or fumes.

WARNINGS:

- The battery has a safety device. Do not disassemble or alter the battery.
- Charge the batteries only when the ambient temperature is between 0° and 40°C (32° and 104°F).
- Do not short-circuit the battery by directly connecting the positive and negative terminals with metal objects.
- Do not heat the battery or discard it in a fire.
- Do not expose the battery to temperatures over 60°C (140°F). Keep it away from fire and other heat sources.
- Do not charge the battery near a heat source, such as a fire or heater.
- Do not leave the battery in direct sunlight.
- Recharge the battery only with the SiteCharge dual battery charger or the system.
- Do not pierce the battery with a sharp object, hit it, or step on it.
- Do not use a damaged battery.
- Do not solder a battery.
- When connecting the battery to the SiteCharge dual battery charger or to the system, never reverse the polarity of the battery terminals.
- The polarity of the battery terminals are fixed and cannot be switched or reversed. Do not force the battery into the system or the SiteCharge dual battery charger.
- Do not connect the battery to an electrical power outlet.
- Do not continue recharging the battery if it does not recharge after two successive six hour charging cycles.

CAUTIONS:

- To avoid the battery bursting, igniting, or fumes from the battery and causing equipment damage, observe the following precautions:
- Do not immerse the battery in water or allow it to get wet.
- Do not put the battery into a microwave oven or pressurized container.
- If the battery leaks or emits an odor, remove it from all possible flammable sources.
- If the battery emits an odor or heat, is deformed or discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult SonoSite or your local representative.
- Store the battery between -20°C (-4°F) and 60°C (140°F).
- Use only SonoSite batteries.

2.3 Biological Safety

Observe the following precautions related to biological safety.

WARNINGS:

- To prevent misdiagnosis, do not use the ECG trace to diagnosis cardiac rhythms. The SonoSite ECG option is a non-diagnostic feature.
- To prevent injury, only use market cleared ECG electrodes and cables.
- Non-medical (commercial) grade peripheral monitors have not been verified or validated by SonoSite as being suitable for diagnosis.
- Do not use the system if it exhibits erratic or inconsistent behavior. Discontinuities in the scanning sequence are indicative of a hardware failure that must be corrected before use.
- Do not use the system if it exhibits artifacts on the LCD screen, either within the clinical image or in the area outside of the clinical image. Artifacts are indicative of hardware and/or software errors that must be corrected before use.
- Some transducer covers contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to the FDA Medical Alert, March 29, 1991.
- Perform ultrasound procedures prudently. Use the ALARA (as low as reasonably achievable) principle.
- SonoSite does not currently recommend a specific brand of acoustic standoff.

2.4 Labeling Symbols

Labeling symbols for SonoSite products can be found in the user guide for each product.

This page intentionally left blank.

CHAPTER 3 System Overview

3.1 Theory of Operation

The SonoSite ultrasound system has seven major functional groups: the transducer, the acquisition subsystem, the processing subsystem, the display subsystem, the control subsystem, the user interface subsystem, and the power subsystem. Figure 3.1 shows how these functions interact.

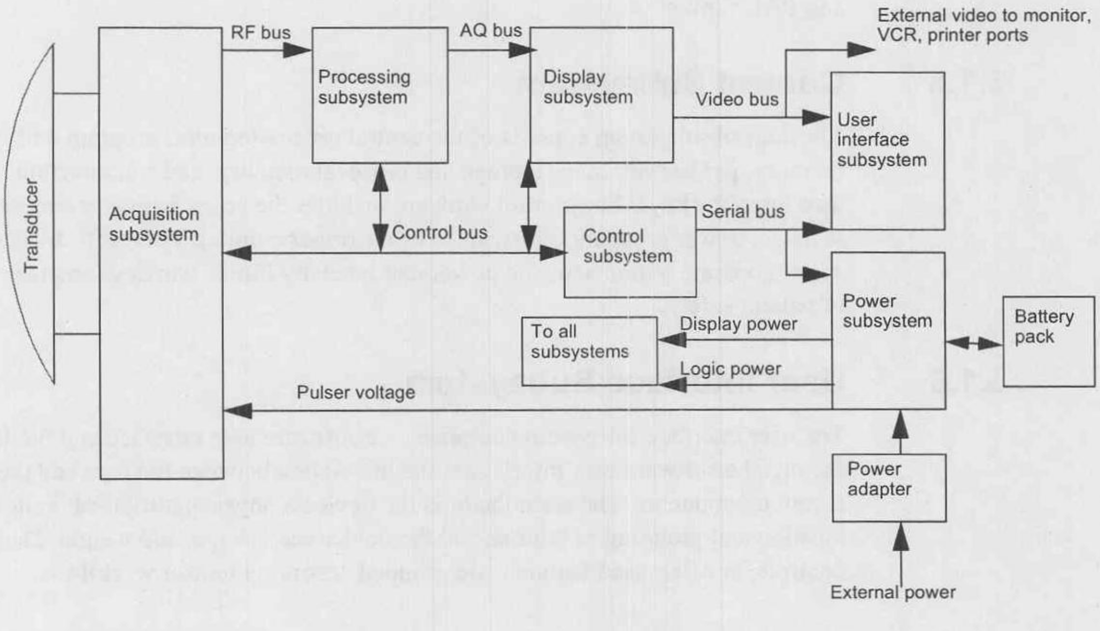

External video to monitor, VCR, printer ports
RF bus
AQ bus
Processing subsystem
Display subsystem
Video bus
User interface subsystem
Transducer
Acquisition subsystem
Serial bus
Control bus
Control subsystem
Power subsystem
Battery pack
To all subsystems
Display power
Logic power
Pulser voltage
Power adapter
External power

Figure 3.1 System Block Diagram

3.1.1 Transducer

The transducer elements convert the pulser voltage to acoustic energy during the "transmit" portion of the ultrasound acquisition cycle. Also, the transducer elements convert the acoustic echo to voltage in the "receive" portion of the acquisition cycle. The system transducers have more than 64 elements. The acquisition subsystem senses the voltage developed on the transducer elements.

3.1.2 Acquisition Subsystem

The acquisition subsystem consists of a beamformer and an interface to the transducer. The beamformer times the "transmit" pulses to focus the acoustic beam. Also, the beamformer amplifies the low-level echo signal and times and focuses the "receive" information.

3.1.3 Processing Subsystem

The high-speed processing subsystem interfaces with the beamformer. The processing subsystem demodulates, filters, detects, and compresses the signal supplied by the beamformer. Next, it sends this data to the display subsystem.

3.1.4 Display Subsystem

The display subsystem converts the detected ultrasound data into picture elements (pixels). The software user interface graphics are combined with the ultrasound information and converted to a video stream. The external video ports support NTSC and PAL format.

3.1.5 Control Subsystem

The control subsystem consists of the central processing unit, program and video memory, permanent image storage and retrieval memory, and a connection to the user interface keys. The control software includes the acoustic power and intensity software power group monitors, and a beamformer monitor. This software makes the system operate within acoustic power and intensity limits, which guarantees a level of patient safety.

3.1.6 User Interface Subsystem

The user interface subsystem comprises the software user interface and the form factor. The software user interface is the interaction between the user and the screen layout components. The form factor is the device's physical attributes: buttons, location and grouping of buttons and the device size, shape, and weight. Dedicated controls, or often-used features, are grouped according to user workflow.

3.1.7 Power Subsystem

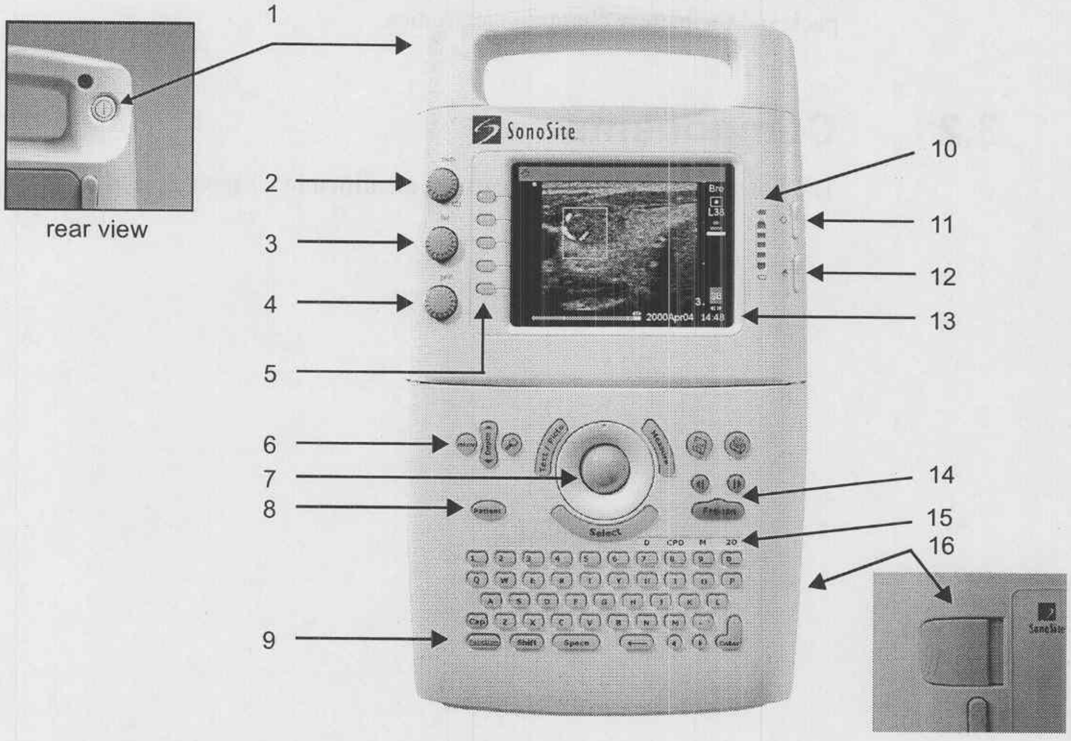
The power subsystem provides power and protects the hardware from destructive or unsafe conditions. This subsystem's hardware and software monitors detect failures in the device. Upon detecting a fault, the system disables the pulser supply, and signals an error to the control subsystem. The power subsystem includes the battery pack and the battery charging electronics.

3.2 Components

The SonoSite system components are identified in Chapter 1, section 1.2.

3.3 Controls

Figure 3.2 shows the SonoSite system controls. The numbers correspond to the control names and functional descriptions in Table 3.1.



Number	Feature	Number	Feature
1	power switch, located on the rear of the system handle	9	Function key
2	near, affects gain of shallow echoes	10	battery charge indicators
3	far, affects gain of deeper echoes	11	LCD (liquid crystal display) brightness control
4	gain, affects overall gain	12	LCD contrast control
5	menu select controls	13	LCD
6	Menu, Depth, and Zoom	14	cine arrow keys and Freeze key
7	trackball	15	mode controls
8	Patient	16	battery release

Figure 3.2 SonoSite Ultrasound System Controls

Table 3.1 SonoSite Ultrasound System Controls

NUMBER	CONTROLS	DESCRIPTION
1	power switch (located on the rear of the system handle)	Turns power on and/or off.
2	near	Affects gain of shallow echoes for 2D.
3	far	Affects gain of deeper echoes for 2D.
4	gain	Affects overall gain in 2D and CPD gain in CPD.
5	menu select controls	Press Patient to access system menus.
6	Menu, Depth, and Zoom	Allows access to imaging parameters; changes the display depth; increases the image size to 2x.
7	trackball	Moves objects on the image display.
8	Patient	Displays the system menus.
9	Function key	Used with number keys (1-6) to display assigned text; used with the "I" key to display system information.
10	battery charge indicators	Indicates a fully-charged battery when all LEDs lit
11	LCD (liquid crystal display) brightness control	Controls LCD brightness.
12	LCD contrast control	Controls LCD contrast.
13	LCD	Adjustable liquid crystal display.
14	cine arrow keys and Freeze key	Press to move either way through the cine series of images.
15	mode controls	Press to access imaging modes (keys 7,8,9,0)
16	battery release	Press to release the battery.

3.4 Accessories

For information about accessories and other SonoSite products, refer to the user guide for each product.

3.4.1 Battery Pack

CAUTIONS:

➤ Use only the specified SonoSite battery pack.For battery safety notes, see **Chapter 2, *Safety,*** on page 5.

The system can be powered from either a battery pack or external power.

The system is powered by a rechargeable, six-cell, 11.1 V dc, 3.0 amp-hours, lithium-ion battery. A fully-charged battery has a run time of 1.5 to 4 hours, depending upon operating conditions. The battery pack case is made of injection molded plastic. When in use, it is inserted into the system. The battery pack has no user-serviceable parts. The operating life of the battery is 1-2 years, depending on how you use the system. Table 3.2 contains battery operating specifications.

Table 3.2 Battery Pack Operation Specifications

BATTERY PACK OPERATION PARAMETER	SPECIFICATION
Operation time during use model	1.5 hours @ 77°F (25°C)
Operation time during power off (leakage and self discharge)	14 days @ 77°F (25°C)
Number of charge discharge cycles (100% depth of discharge)	500 @ 70°F (21°C)

3.4.1.1 Battery Charge Indicators

The battery charge indicators, which consist of light-emitting diodes (LEDs) on the system, indicate the current battery level.

- All LEDs lit mean the system battery is fully charged.
- Some LEDs lit mean the system battery is partially charged.

Table 3.3 contains the charging requirements for the system.

Table 3.3 System Charging Requirements

SYSTEM CHARGING PARAMETER	SPECIFICATION
Charge time to 80% capacity (internal charger) with the system off	3 hours @ 77°F (25°C)
Charge time to 80% capacity (internal charger) with the system on	12 hours @ 77°F (25°C)

3.4.2 External Power

The external power connection provides the system electricity via the power adapter. External power charges the battery pack and powers the system in low battery conditions.

3.4.2.1 External System Connections

Figure 3.3 shows the following external system connections:

- A DC line voltage connector (1) connects the system to a power adapter.
- An I/O connector (2) provides for connection to a PC or input of an ECG signal for ECG display on the monitor.
- A print control connector (3) connects the system to a printer.
- A video out connector (4) provides a composite video signal for a VCR, printer, or external video monitor.

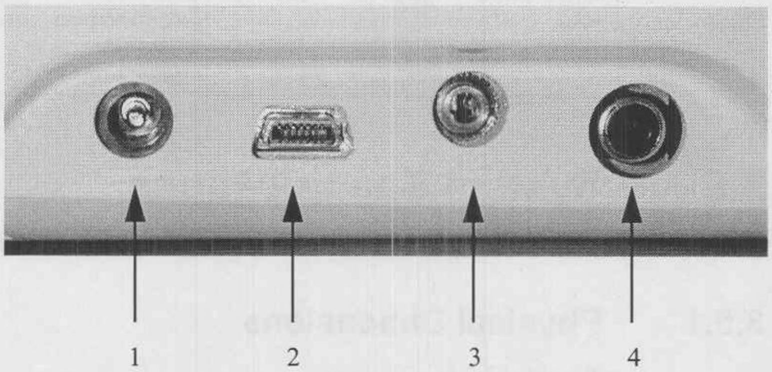


Figure 3.3 External System Connections

Table 3.4

NUMBER	
1	DC line voltage connector
2	I/O connector
3	Print control connector for a recommended printer
4	Video out connector for a recommended VCR, printer, or external video monitor

3.4.3 Power Adapter

CAUTION:

➤ Use only the specified SonoSite power adapter.

A universal power adapter (50–60 Hz, 100–240 V ac) can power the SonoSite system. When the system is plugged into a wall outlet, the battery pack recharges. Recharging a battery which is not fully discharged will not decrease battery life. Keep the ambient temperature between 32° and 104°F (0° and 40°C) to charge a battery successfully. To maintain battery charge, attach the power adapter to the system when the device is not in use.

Power Cord

Table 3.5 Power Cord Specifications

CONFIGU-RATION	LENGTH	RATING	MALE PLUG	FEMALE CONNEC-TOR	APPRO-VALS	MARKING
100-120 V ac ACC/ 60 Hz	9 ft. 10 in.	250 V ac	MA 5-15P Hospital grade, grounding type molded on	CEE-22, molded on	UL, CSA	Manufac-turer, Agency Approvals
230 V ac /50 Hz / PAL 230 V ac / 60 Hz	3 m	250 V ac	CEE-7/VII grounding type with 4.8 mm pins molded on	CEE-22, molded on	EU	Manufac-turer, Agency Approvals

3.5 System Specifications

This section provides specifications for the SonoSite ultrasound system.

3.5.1 Physical Dimensions

Height: 13.3 in. (33.8 cm)

Width: 7.6 in. (19.3 cm)

Depth: 2.5 in. (6.35 cm)

Weight: 5.4 lbs (2.46 kg) with the C60 transducer connected

3.5.2 Monitor

Height: 3.1 in. (7.9 cm)

Width: 4.3 in. (10.9 cm)

Diagonal: 5 in. (12.7 cm)

Brightness control

Contrast control

3.5.3 Transducers

C60/5-2 MHz 60-mm

C15/4-2 MHz 15-mm

C11/7-4 MHz 11-mm

ICT/7-4 MHz 11-mm

L38/10-5 MHz 38-mm

3.5.4 Imaging Modes

2D Imaging (256 gray shades)

CPD Imaging (64 colors)

M-mode

PowerMap DCPD Imaging (64 colors)

Pulsed Wave (PW) Doppler

Tissue Harmonic Imaging

3.5.5 Image Storage

Up to 119 images (depending on the configuration of the system)

Cine review

3.5.6 Temperature, Pressure, and Humidity Limits

3.5.6.1 System Operating

- 50–104°F (10–40°C), 15–95% R.H.
- 700-1060hPa (0.7 ATM to 1.05 ATM)

3.5.6.2 System Shipping/Storage

- -31–149°F (-35–65° C), 15–95% R.H.
- 500-1060hPa (0.5ATM to 1.05 ATM)

3.5.6.3 Battery Operating

- 50–104°F (10–40°C), 15–95% R.H.

3.5.6.4 Battery Shipping/Storage

- -4–140°F (-20–60°C), 0–95% R.H.

3.5.6.5 Transducers Operating

- 50–104°F (10–40°C), 15–95% R.H.

3.5.6.6 Transducers Shipping/Storage

- -31–149°F (-35–65°C), 15–95% R.H

3.5.7 Electrical

- System optional: 100-120/220-240 V ac, 50/60 Hz input, 16.0 V dc output power adapter
- SiteCharge dual battery charger input voltage: 16.0 V dc, 2.8 A
- SiteCharge dual battery charger output voltage: 12.6 V dc, 3.0 A (2x)
- AC power adapter input: 100-120/220-240 V ac, 50/60 Hz, 1.0-0.50 A
- AC power adapter output: + 16.0 V dc, 2.8 A

3.6 Battery

- 6-cell, 11.1 V dc, 3.0 amp-hours, rechargeable, lithium-ion battery pack
- Run time: 1.5 to 4 hours, depending upon operating conditions

3.7 Safety Requirements

3.7.1 Meets Electromechanical Safety Standards

EN 60601-1:1997, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety.

EN 60601-1-1:1993, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety–Section 1-1. Collateral Standard. Safety Requirements for Medical Electrical Systems.

EN 60601-1-2:1998, European Norm, Medical Electrical Equipment. General Requirements for Safety-Collateral Standard. Electromagnetic Compatibility. Requirements and Tests.

EN 60601-2-25: 1996, European Norm, Medical Electrical Equipment–Part 2. Particular Requirements for Safety–Section 25. Specification for Electrocardiographs.

C22.2, No. 601.1:1998, Canadian Standards Association, Medical Electrical Equipment–Part 1. General Requirements for Safety.

CEI/IEC 61157:1992, International Electrotechnical Commission, Requirements for the Declaration of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment.

UL 2601-1:1999, Underwriters Laboratories, Medical Electrical Equipment-Part 1: General Requirements for Safety.

3.7.2 Meets EMC/EMI Standards

IEC 61000-4-2:1999, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 4.2: Electrostatic Discharge/Immunity Test-Basic EMC Publication

IEC 61000-4-3:1997, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 3: Radiated Radio-Frequency, Electromagnetic Field Immunity Test.

IEC 61000-4-4:1995, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 4, Electrical Fast Transient/Burst Immunity Test-Basic EMC Publication.

IEC 61000-4-5:1999, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 5, Surge Immunity Test.

CISPR11:97, International Electrotechnical Commission, International Special Committee on Radio Interference. Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement.

3.7.3 Meets Airborne Equipment Standards (without ECG Cable Attached)

RTCA/DO160D:1997, Radio Technical Commission for Aeronautics, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21.0 Emission of Radio Frequency Energy, Category B.

3.7.4 Meets ECG Standard

AAMI EC53:1995, Association for the Advancement of Medical Instrumentation, ECG Cables and Lead Wires.

This page intentionally left blank.

CHAPTER 4 Setup and Operation

WARNING:

- ➤ CRITICAL TEST FUNCTION - Skipping the functional tests in this procedure could adversely affect safety or effectiveness of the system.

Operation of the SonoSite ultrasound system can be found in the user guide provided with each system.

4.1 Connecting and Removing Transducers

The system comes with one or more transducers. Only one transducer can be connected to the system at a time.

WARNING:

- ➤ The transducer connector can become hot during operation. This is normal. Operate the system in the SiteStand mobile docking station or on a flat, hard surface to allow air flow past the connector.

CAUTION:

- ➤ The electrical contacts inside the system transducer connector may be damaged by foreign material or by rough handling. Do not touch the electrical contacts. Keep foreign material out of the connector. Keep a transducer connected to the system whenever possible.

To connect the transducer:

1. On the transducer connector, pull the latch up and rotate it clockwise until it snaps to a stop (Figure 4.1). The latch should be easy to move. Do not force the latch.
2. Align the transducer connector with the connector on the rear of the system and insert it by pushing the transducer connector into the system connector. The transducer connector should be easy to insert. Do not force the transducer connector.
3. Turn the latch counterclockwise until it snaps to a stop.

4. Press the latch down until it snaps into place, securing the transducer connector to the system.

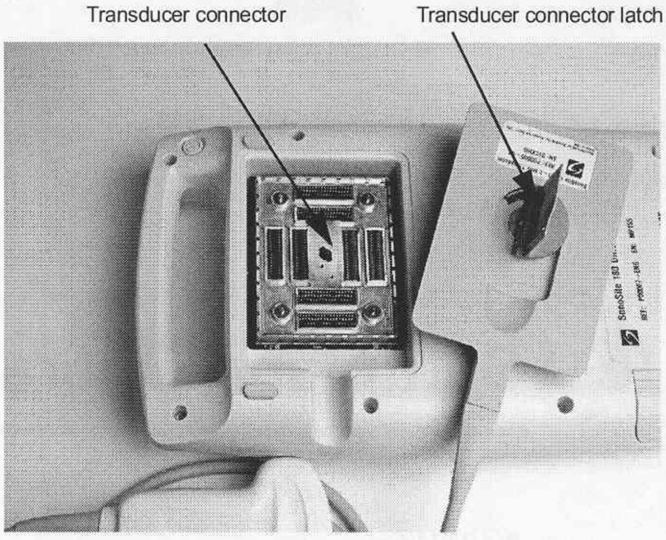


Figure 4.1 Connecting the Transducer

To remove the transducer:

1. On the transducer connector, pull the latch up and rotate it clockwise until it snaps to a stop (Figure 4.1).
2. Carefully pull the transducer connector away from the system.

4.2 Turning the System On and Off

When turning power on or off, you must push and hold the **Power** switch for approximately one second before the system responds. This feature prevents battery discharge, resulting from accidentally turning the system on. It also prevents accidentally turning the system off during an exam.

The first time you turn on the system, set the date and time. See the *SonoSite Ultrasound System User Guide.*

CAUTION:

➤ Do not use the system if an error message appears on the image display. Note the error code. Call SonoSite or your local representative. When an error code occurs, turn off the system by pressing and holding the power switch until the system powers down.

To turn on power:

1. Locate the **Power** switch on the back of the left side of the system handle. See Figure 3.2, *SonoSite Ultrasound System Controls,* on page 14.
2. Press and hold the **Power** switch until the system beeps or until you see the image display.
3. Release the **Power** switch.

To turn off power:

1. Press and hold the **Power** switch.

   You will hear the system emit two sets of "high-low" beeps. The system powers off after the second set of beeps.

2. Release the **Power** switch.

To wake up the system:

- The system has a sleep delay, which is activated through the **sleep delay** system setup. When the battery charge indicators are blinking, but the other system lighting is off, press any system control to wake up the system.

4.3 Installing and Removing the Battery

The battery comprises six lithium-ion cells (two sets of three connected in series) plus electronics, a temperature sensor, and the battery contacts. When in use, it is inserted into the system.

WARNING:

➤ If you are holding the system, when you remove the battery, place your hand beneath the battery. If it falls to the floor, it could be damaged, or cause personal injury.

If the battery is being installed for the first time, it will need to be charged. Make sure to remove the protective tape from the battery contacts before charging the battery.

To install the battery:

1. Locate the battery compartment at the bottom of the system (Figure 4.2).
2. Install a new battery (label side up) into the battery compartment by pushing it into the compartment until it clicks in place. (Do not force the battery into the compartment, check the battery orientation if it is difficult to install.) Ensure that both sides of the battery are fully connected and that the battery release button is not pressed.

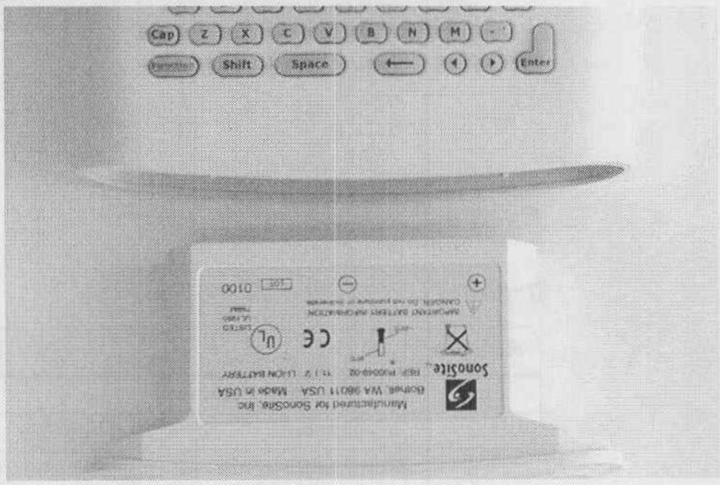


Figure 4.2 Inserting the Battery

To remove the battery:

1. Turn off the system.
2. Locate the battery compartment at the bottom of the system.

WARNING:

- If you are holding the system, when you remove the battery, place your hand beneath the battery. If it falls to the floor, it could be damaged, or cause personal injury.

3. To release the battery, press the battery release button (lower, right side) on the system.

4.4 Using AC Power

The battery charges when the system is using AC power. If the system is off and connected to AC power, a fully discharged battery will charge in about three hours.

To operate the system using AC power:

1. Connect the line cord to the AC power adapter.
2. Connect the line cord to a hospital-grade electrical outlet.
3. Connect the AC power adapter to the system using the upper, left connector on the left side of the system. (Figure 4.3).

Note: You must wait approximately 10 seconds after connecting to AC power before turning on the power switch.

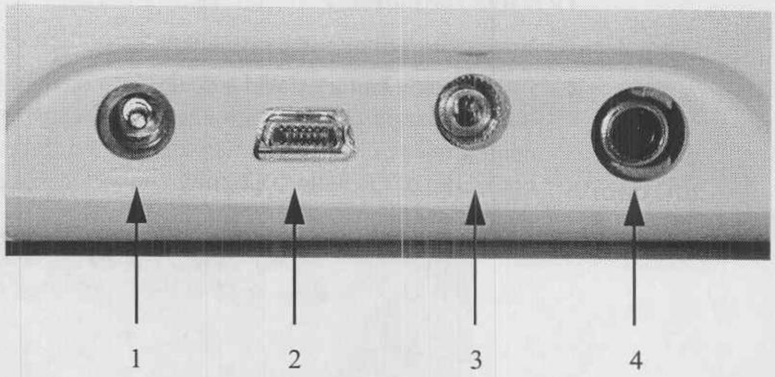


Figure 4.3 System Connections

Table 4.1 System Connections

NUMBER	FEATURE
1	DC line voltage connector
2	I/O connector
3	Print control connector for a recommended printer
4	Video out connector for a recommended VCR, printer, or external video monitor

4.5 Upgrading the System Software

Transducers that you receive from SonoSite may contain either required or optional upgrades to the system software that resides on your SonoSite system.

Whenever you connect a transducer to a SonoSite system, the system communicates with the transducer to determine if it contains software that would upgrade the system.

CAUTION:

➤ Initiating any upgrade of the system software erases any images stored on your system. Do not upgrade the system software until you have determined that any stored images are no longer needed.

To upgrade the system software:

1. When you first connect a transducer with new software and turn the system on, the following message displays:
   Do you want to upgrade the system software?

For required upgrades:

You must perform the software upgrade or replace the transducer with one that is compatible with the software currently installed on your system. Do one of the following:

- Select **no** (disconnect transducer) to reject the system software upgrade.
- Select **yes** (up to 20 minutes) to accept the system software upgrade and go to step 2.

For optional upgrades:

You may either install the new software or continue to use the existing software. SonoSite recommends that you install these optional upgrades soon after receiving them. Do one of the following: Select **no** (continue) to use the system without upgrading.

- Select **yes** (up to 20 minutes) to accept the upgrade and go to step 2.

2. When you have accepted the upgrade, the system loads the new software and displays the following message:
   Upgrade in progress (20 minutes total).

   Note: The system upgrade can take up to 20 minutes; however, many software upgrades will be completed in less time.

To cancel the upgrade in progress, select **cancel.**

If this is a required upgrade:

- The existing software remains installed.
- The system displays the following message:
  Incompatible transducer, upgrade the system software.

If this is an optional upgrade:

- The existing software remains installed.
- The system will go to live scan.

3. When the system has loaded the new software, the following message displays:
   Successful upgrade.

   If the software upgrade is unsuccessful, the system displays an error code and you must contact SonoSite technical support. U.S. customers, call **1-877-657-8118**. International customers, call **1-425-951-1330** or contact your local representative.

4. Select **reboot** to restart your system.

   During the restart, the initial system screen will show two progress indicator bars. These progress indicator bars are present while the system is replacing its operating software and will disappear when the process is complete.

   When the operating software has been replaced, the system presents you with the license update screen so that you may license the software. At this point, the software upgrade process is complete, but the system software is not yet licensed. The following section explains how to license your software.

4.6 Obtaining A License Key

A license key is required to update your SonoSite system. To obtain a license key, do one of the following:

If you encounter difficulty with the system, use the information in this chapter to help correct the problem. If the problem is not covered here, call SonoSite technical support at the following numbers or addresses:

USA/Canada Customers

- Technical support: **1-877-657-8118**
- Technical support fax and email: **1-425-951-6700**; **service@sonosite.com**
- SonoSite website: www.sonosite.com

International Customers

- Call your local representative or **1-425-951-1330**.

To receive your license key, you will need to provide the following information, which is displayed on the system information screen of your system (except for the person installing the upgrade and the system serial number):

- Name of the person installing the upgrade
- System serial number (SN) (located on the back of your system)
- ARM Ver: (version)
- PCBA Serial No: (number)

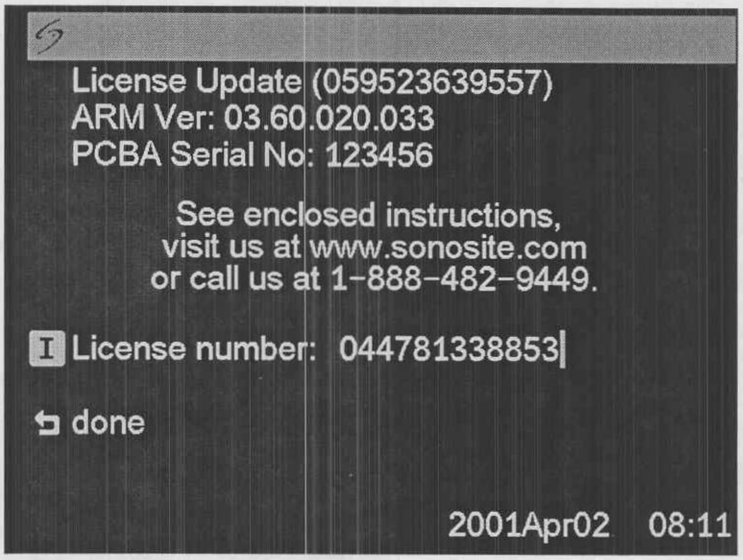
See Section 4.6.1.1, *Displaying the System Information Screen,* on page 30. If the system is on and the grace period expires, view the license information screen on the system information screen.

4.6.1 Installing A License Key

When you have obtained a license key for your software, you must enter it into the system. Once a valid license key has been entered, the system remains licensed until the next time the system software is upgraded.

1. Turn on the system. If the software is not yet licensed, the license update screen displays (Figure 4.4).

The license update screen displays the following information: the License Update number, the ARM Ver (version), the PCBA Serial No. (number), the SonoSite web site address and telephone number, the license number, the register later or done ↩, and the grace period (time remaining) on your system.



License Update (059523639557)
ARM Ver: 03.60.020.033
PCBA Serial No: 123456

See enclosed instructions,
visit us at www.sonosite.com
or call us at 1-888-482-9449.

License number: 044781338853

done

2001Apr02 08:11

Figure 4.4 License Update Screen

Note: The software versions on your system may vary based on your upgrade and configuration.

2. Enter your license key in the license number field.

If the license key that you entered is recognized by the system as being valid for your system and the software you installed, **done** appears on-screen. Select **done** from the on-screen menu to install the license key and license your software.

If the license key that you entered is not recognized by the system, the register later button remains on the screen as long as the defined grace period has not expired.

If the grace period has expired, the menu item will indicate this by showing zero hours remaining in the grace period. At this point, you must then enter a valid license key before you can use the system with this or any other transducer.

Note: If you have entered a valid license key and you cannot complete the licensing procedure, verify that the license key has been entered correctly. The license key should be exactly 12 digits (for example, 123348990552) with no other characters or punctuation.

*Note: If after confirming correct entry of the license key, you are still unable to license your system, call SonoSite technical support. USA/Canada customers call **1-877-657-8118**. International customers call your local representative or **1-425-951-1330**.*

If the system is on and the grace period expires, the license update screen must be displayed from the system information screen.

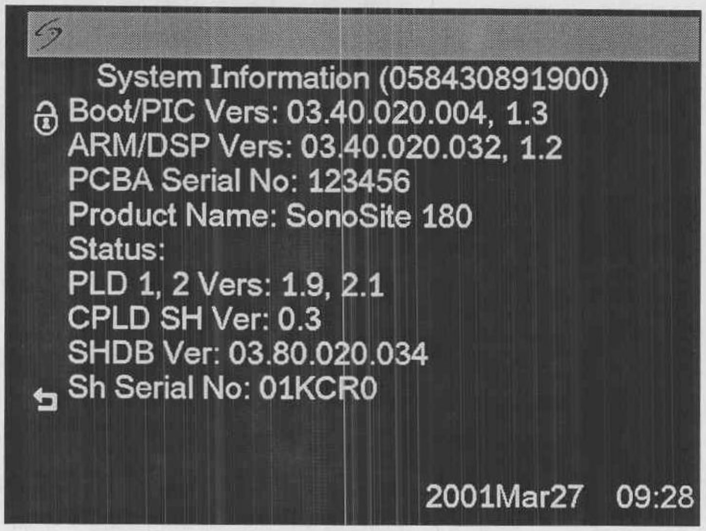
4.6.1.1 Displaying the System Information Screen

To display the system information screen:

1. Press and release the **Function** key.
2. Press and release **I**. The system information screen displays (Figure 4.5).

   The system information screen displays the following information: the Boot/PIC Vers (version), the ARM/DSP Vers, the PCBA Serial No (number), the Product Name, the Status, the PLD 1, 2, Vers, CPLD SH Ver, SHDB Ver (scanhead database version), and the Sh Serial No (scanhead serial number).

   Note: The software versions on your system may vary based on your upgrade and configuration.



System Information (058430891900)
Boot/PIC Vers: 03.40.020.004, 1.3
ARM/DSP Vers: 03.40.020.032, 1.2
PCBA Serial No: 123456
Product Name: SonoSite 180
Status:
PLD 1, 2 Vers: 1.9, 2.1
CPLD SH Ver: 0.3
SHDB Ver: 03.80.020.034
Sh Serial No: 01KCR0
2001Mar27 09:28

Figure 4.5 System Information Screen

To display the license update screen:

1. On the system information screen, select the **unlock icon** (upper left corner of the screen).

The license update screen displays.

2. Perform the steps in Section 4.6.1, *Installing A License Key,* on page 28.

4.7 Checking and Charging the Battery

To check the battery:

Note: Disconnect the system from AC power before checking the battery charge. Five LEDs (light-emitting diodes) on the right side of the system monitor allow you to check the battery condition. If all LEDs are lit, the battery is fully charged. A solid dark gray battery icon in the lower right portion of the system display indicates a low battery. A solid white battery icon indicates approximately 10 minutes of battery life remaining. A flashing white battery icon indicates approximately 2 minutes of battery life remaining.

The system will operate on a fully-charged battery for 1.5 to 4 hours, depending upon use. Ensure the battery is charged at all times to provide the longest possible battery operation. You can set the **sleep delay** and **power delay** to prolong battery life.

When the system is not likely to be used for some time, to prevent total battery discharge, remove the battery from the system.

To charge the battery:

CAUTION:

➤ Charge batteries only when the ambient temperature is between 32° and 104°F (0° and 40°C).

1. Connect the AC line cord of the AC power adapter to a hospital-grade electrical outlet.
2. Connect the DC line cord of the AC power adapter to the power connector on the system. (1) (Figure 4.6 and Table 4.2).
3. Charge the battery until it is fully charged.
   Note: It takes about three hours to charge a battery when the system is off.
4. Disconnect the system from AC power.
5. Turn the system on to check the battery charge.

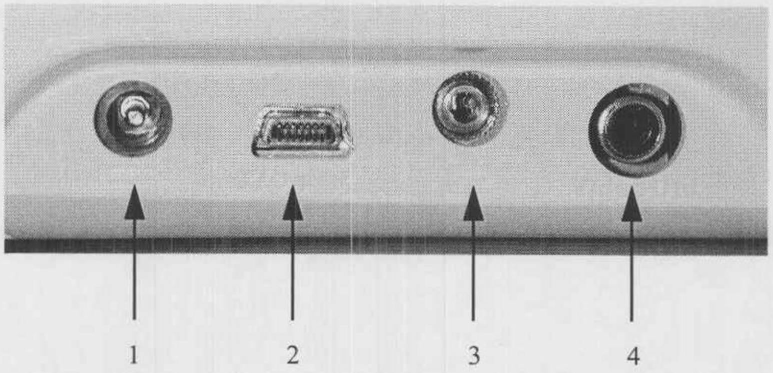


Figure 4.6 System Connections

Table 4.2 System Connections

NUMBER	
1	DC line voltage connector
2	I/O connector
3	Print control connector for a recommended printer
4	Video out connector for a recommended VCR, printer, or external video monitor

This page intentionally left blank.

CHAPTER

5 Cleaning and Disinfecting

5.1 Universal Precautions

SonoSite recommends that personnel who have regular exposure to medical devices returned for service practice “universal precautions.” Universal precautions are an approach to infection control. Those servicing this product should follow the prescribed standards for their area.

5.2 Receipt of Suspected Contaminated Materials

- If visual inspection suggests possible contamination when opening a product returned for service, take proper steps to contain the contamination. Wear necessary Personal Protective Equipment (PPE) (gloves, masks, and gowns) when opening or examining a suspect package.
- Before transfer to a service area, label the suspect package “contaminated” and seal it to prevent exposure.
- Discard any packing materials removed from a package suspected of contamination in a biohazard container.
- Discard any contaminated materials received with the product in an appropriate biohazard container. Contaminated materials may include biohazardous waste and sharps.
- Maintain a disinfecting agent in case any work surface is contaminated. The recommended agent is 0.5% sodium hypochlorite (bleach) solution. To prepare the agent, mix one part household bleach (5.25% - 6% sodium hypochlorite) to nine parts water. Spray or wipe the solution onto the work surface and allow to air dry.

Please use these recommendations when cleaning or disinfecting your ultrasound system, transducers, and accessories. This chapter assists in effective cleaning and disinfection, but it is also intended to protect the system and transducers against damage during cleaning or disinfection.

For more information about cleaning or disinfecting solutions or ultrasound gels for the transducer, call SonoSite technical support or your local representative. For information about a specific product, call the product manufacturer.

5.3 Recommended Disinfectants

For a list of disinfectants recommended for use on the SonoSite ultrasound system and transducers, see the *SonoSite Ultrasound System User Guide*.

CHAPTER 6

Troubleshooting

6.1 System and Subsystem Diagnosis

This section covers basic diagnostic and troubleshooting procedures you may need if the system does not operate properly. To diagnose system failures, consult Table 6.1 and the referenced diagnostic figures that follow.

Table 6.1 Troubleshooting Subassemblies and Diagnostic Figures

SUBASSEMBLIES	DIAGNOSTIC FIGURES
Display	Figure 6.2
External Display	Figure 6.3
Control Panel	Figure 6.4
Trackball	Figure 6.5
System	Figure 6.6
Battery	Figure 6.7

6.2 System Repair

The system is repairable through subassembly replacement.

6.3 Test Equipment

There is no test equipment required for this troubleshooting section. Test aids include an external monitor, a spare battery, and a SiteCharge dual battery charger.

6.4 Failures

6.4.1 Display

Attach an external monitor to the external video connector to verify display failures. For example, if the system display is blank and the external monitor works properly, the system display requires servicing.

6.4.2 Control Panel

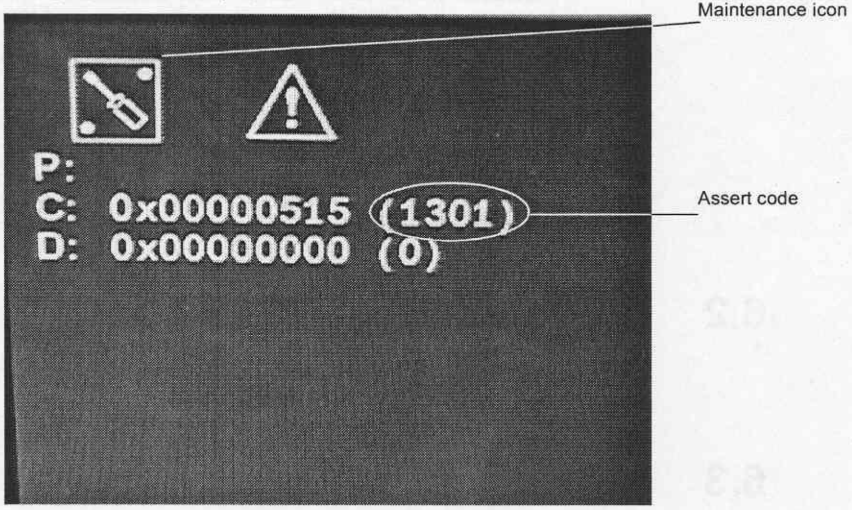
Go to the patient information screen and press each individual key on the keyboard to identify and verify control panel failures. Press function keys and note their response.

6.4.3 Trackball

Intermittent function or loss of control indicates trackball failures. Clean the trackball by removing the retainer ring and then removing the ball.

6.4.4 Main PCBA

The main PCBA can present symptoms that may be difficult to assess. Main PCBA failures result in "assert codes" that are output to the display. Note these assert codes and contact SonoSite technical support, per Appendix B, *Service Event Report,* on page 87, to clarify the failure. Figure 6.1 shows an assert code and a maintenance icon displayed on the system screen.



```
P:
C: 0x00000515 (1301)
D: 0x00000000 (0)
```

Figure 6.1 Assert Code and Maintenance Icon

6.4.5 Clearing the Main PCBA Failure

After the assert code has been recorded, power down the system.

1. Press the Power switch on the system until the power turns off (approximately 5–10 seconds).
2. Turn the power back on to check if the fault cleared or if the condition remains.

   If the condition cleared, you may use the system. If the condition remains, corrective action must be taken before the system can be used.

6.4.6 Battery

If the system does not operate or does not run for the expected duration for a given charge, battery failure is likely.

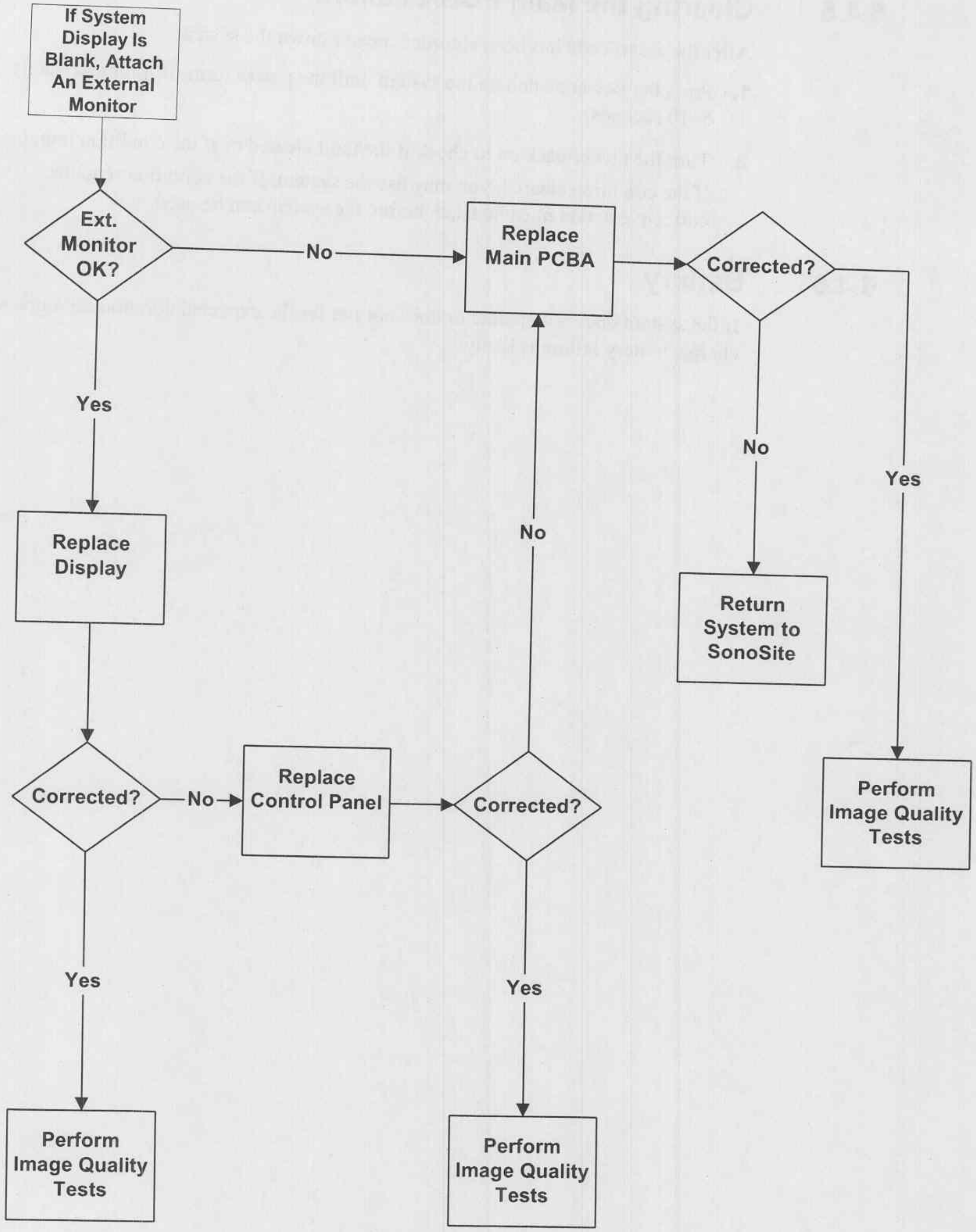

If System Display Is Blank, Attach An External Monitor
Ext. Monitor OK?
No
Replace Main PCBA
Corrected?
Yes
No
Return System to SonoSite
Perform Image Quality Tests
Yes
Replace Display
Corrected?
No
Replace Control Panel
Corrected?
No
Yes
Perform Image Quality Tests
Yes
Perform Image Quality Tests

Figure 6.2 Display Diagnosis

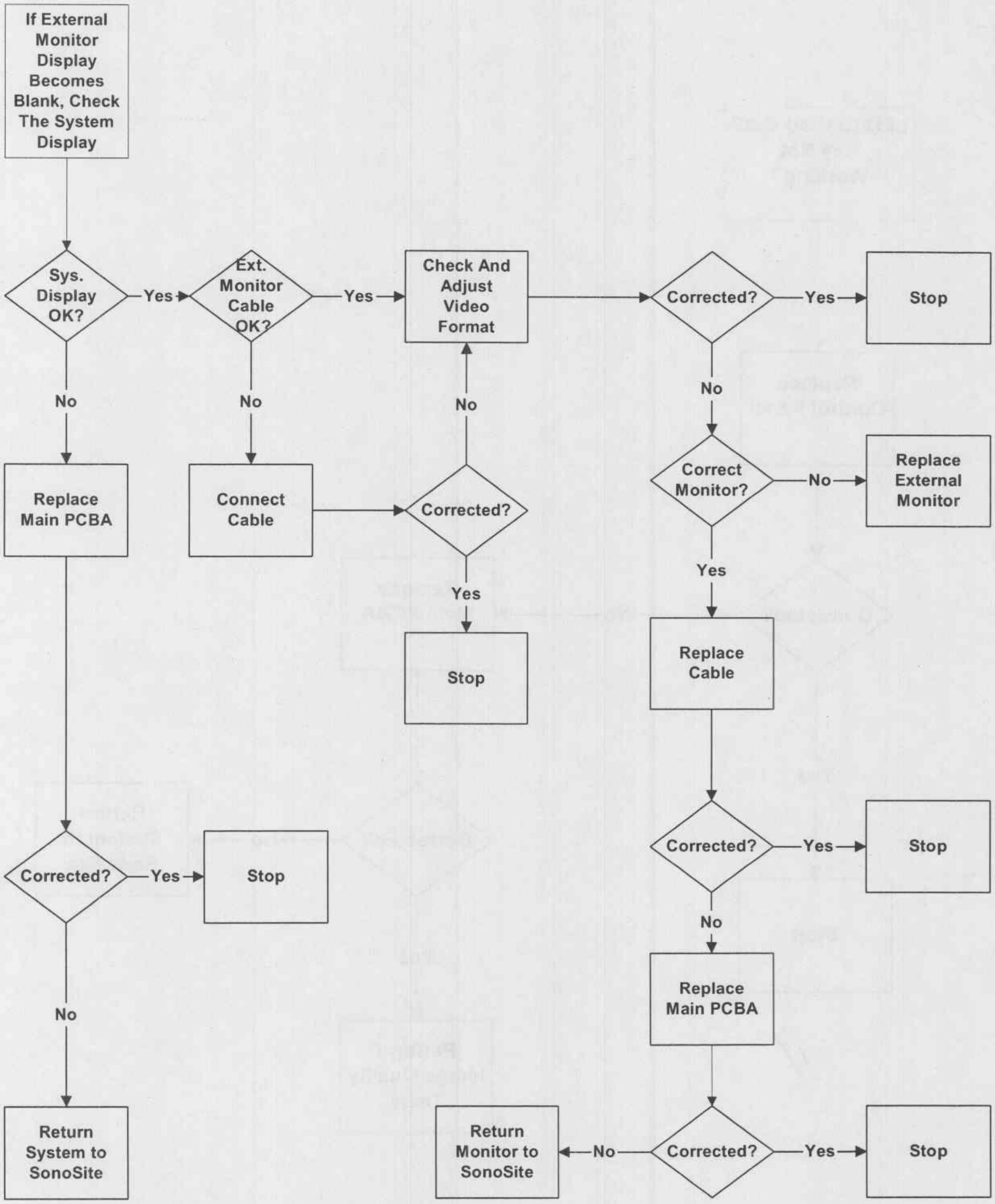

If External Monitor Display Becomes Blank, Check The System Display
Sys. Display OK?
Yes
Ext. Monitor Cable OK?
Yes
Check And Adjust Video Format
Corrected?
Yes
Stop
No
Correct Monitor?
No
Replace External Monitor
Yes
Replace Cable
Corrected?
Yes
Stop
No
Replace Main PCBA
Corrected?
Yes
Stop
No
Return Monitor to SonoSite
No
Replace Main PCBA
Corrected?
Yes
Stop
No
Return System to SonoSite
No
Connect Cable
Corrected?
No
Yes
Stop

Figure 6.3 External Monitor Diagnosis

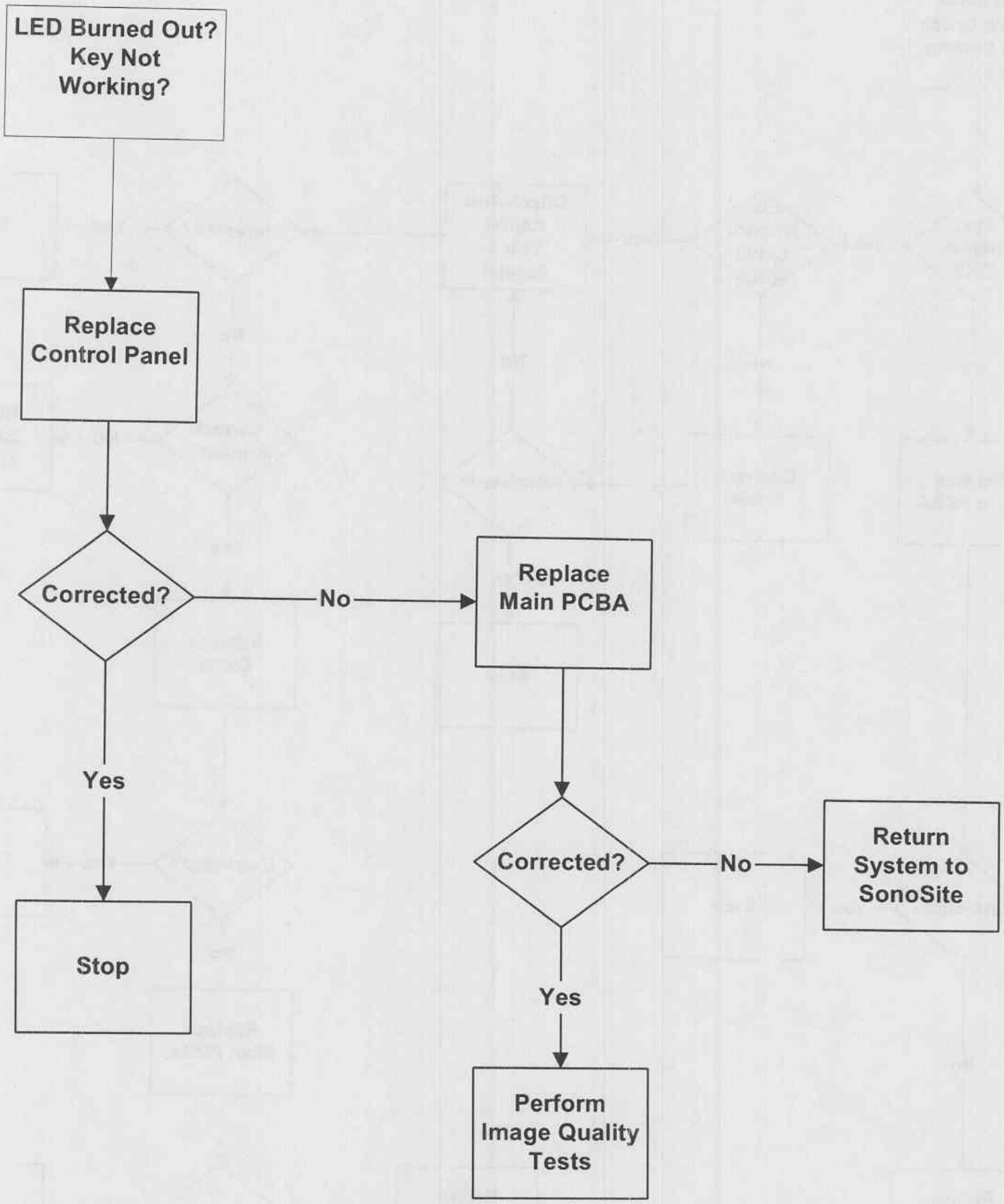

LED Burned Out? Key Not Working?
Replace Control Panel
Corrected?
No
Replace Main PCBA
Yes
Stop
Corrected?
No
Return System to SonoSite
Yes
Perform Image Quality Tests

Figure 6.4 Control Panel Diagnosis

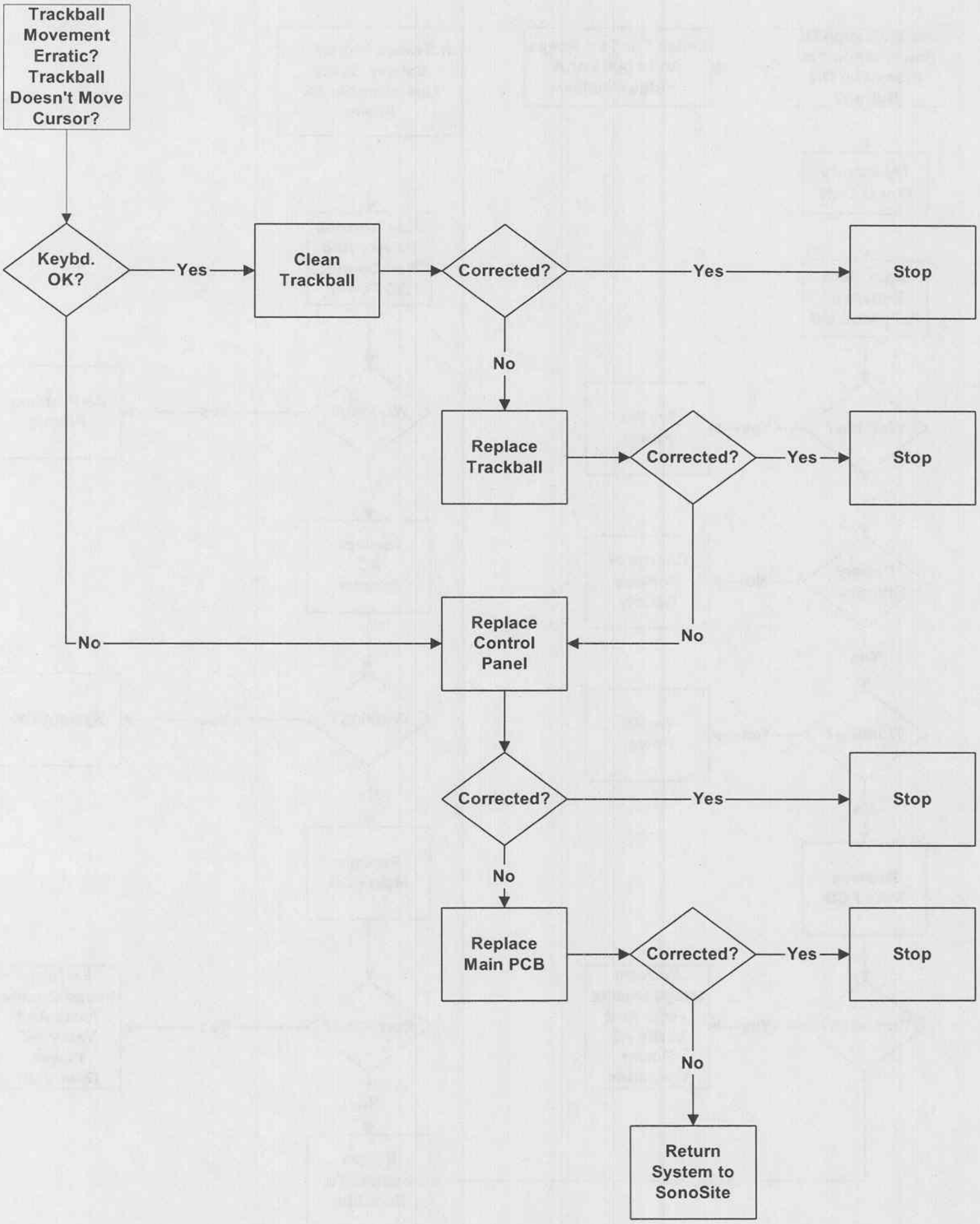

Trackball Movement Erratic? Trackball Doesn't Move Cursor?
Keybd. OK?
Yes
Clean Trackball
Corrected?
Yes
Stop
No
Replace Trackball
Corrected?
Yes
Stop
No
No
Replace Control Panel
Corrected?
Yes
Stop
No
Replace Main PCB
Corrected?
Yes
Stop
No
Return System to SonoSite

Figure 6.5 Trackball Diagnosis

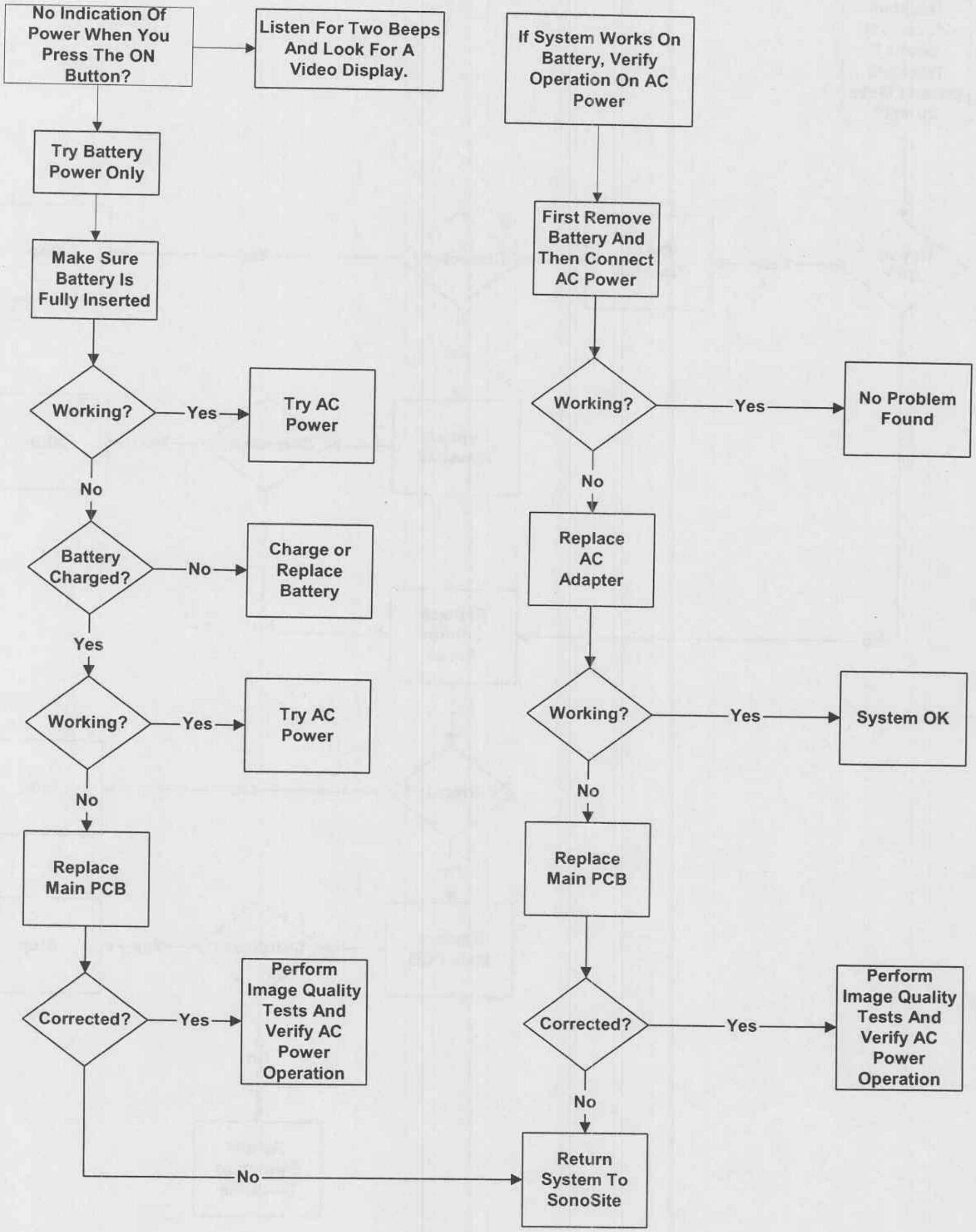

No Indication Of Power When You Press The ON Button?
Listen For Two Beeps And Look For A Video Display.
Try Battery Power Only
Make Sure Battery Is Fully Inserted
Working?
Yes
Try AC Power
No
Battery Charged?
No
Charge or Replace Battery
Yes
Working?
Yes
Try AC Power
No
Replace Main PCB
Corrected?
Yes
Perform Image Quality Tests And Verify AC Power Operation
No
If System Works On Battery, Verify Operation On AC Power
First Remove Battery And Then Connect AC Power
Working?
Yes
No Problem Found
No
Replace AC Adapter
Working?
Yes
System OK
No
Replace Main PCB
Corrected?
Yes
Perform Image Quality Tests And Verify AC Power Operation
No
Return System To SonoSite

Figure 6.6 System Diagnosis

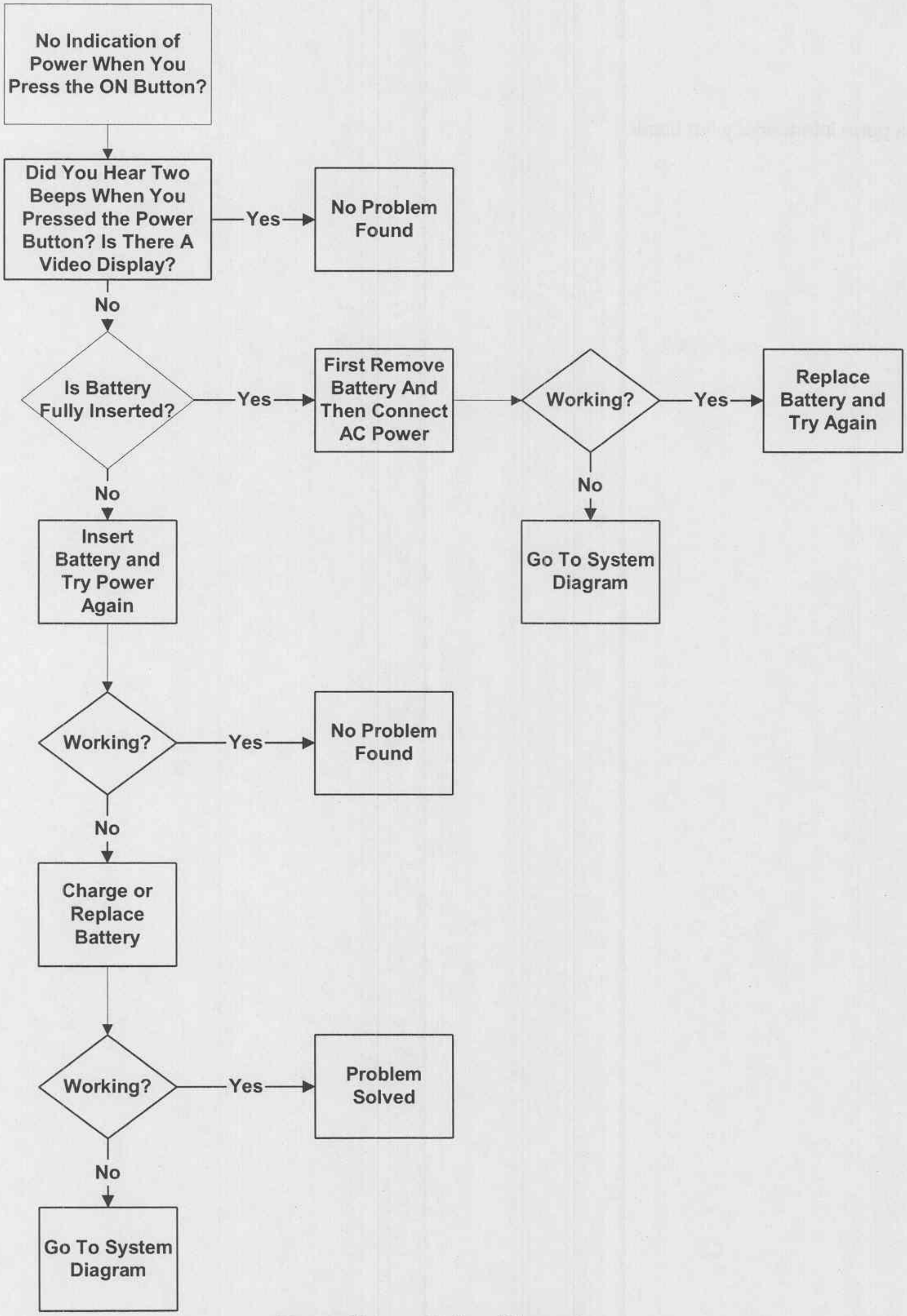

No Indication of Power When You Press the ON Button?
Did You Hear Two Beeps When You Pressed the Power Button? Is There A Video Display?
Yes
No Problem Found
No
Is Battery Fully Inserted?
Yes
First Remove Battery And Then Connect AC Power
Working?
Yes
Replace Battery and Try Again
No
Go To System Diagram
No
Insert Battery and Try Power Again
Working?
Yes
No Problem Found
No
Charge or Replace Battery
Working?
Yes
Problem Solved
No
Go To System Diagram

Figure 6.7 Battery Diagnosis

This page intentionally left blank.

CHAPTER 7

Replacement Procedures

7.1 Display Subassembly Replacement

*Note: Consult **Chapter 6, Troubleshooting,** on page 35 before making any repairs.*

7.1.1 Required Parts

Service Assembly, Display, C1.9 (P02081)

The Display Assembly does not include a label. One of the following labels must be ordered and installed on the display. It must match the label on the display that is being removed.

Label "180PLUS" (P01991)

Label "SonoHeart PLUS" (P01992)

Label "180 Vet" (P01993)

7.1.2 Required Tools and Materials

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb. (0.23–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

CAUTION:

➤ Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. Initial ESD symptoms may be slightly degraded performance or image quality.

7.1.3 Removing the Display Subassembly

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Remove the two screws in the battery compartment with a #1 Phillips screwdriver; this releases the Control Panel Subassembly from the top housing (Figure 7.1).

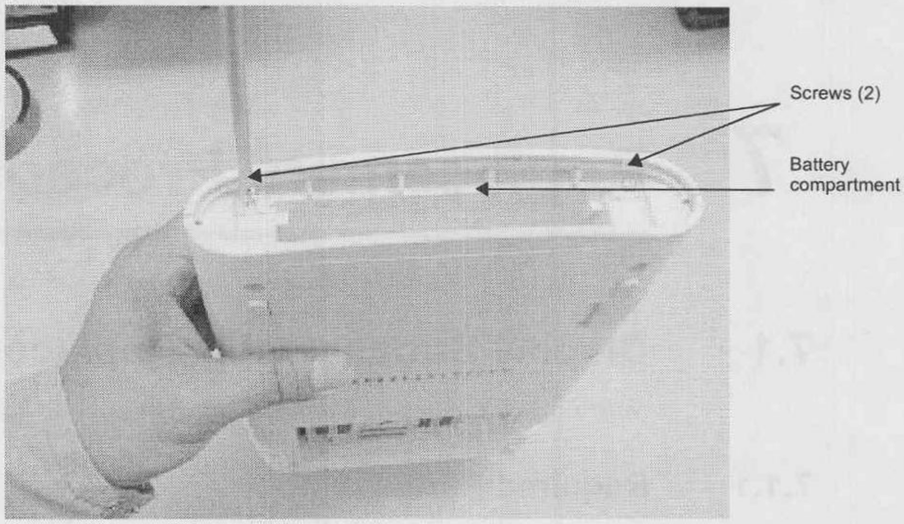


Figure 7.1 Removing the Control Panel Subassembly

3. Insert an anti-static mat between the Control Panel Subassembly and the Display Subassembly to prevent damaging the display LCD (Figure 7.2).
4. Lay the Control Panel Subassembly over onto the Display Subassembly to expose the wire harness and flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the Display Subassembly Wire Harness and unlatch two flex circuits connectors from the Control Panel Subassembly (Figure 7.2).
7. Set the Control Panel Subassembly aside.

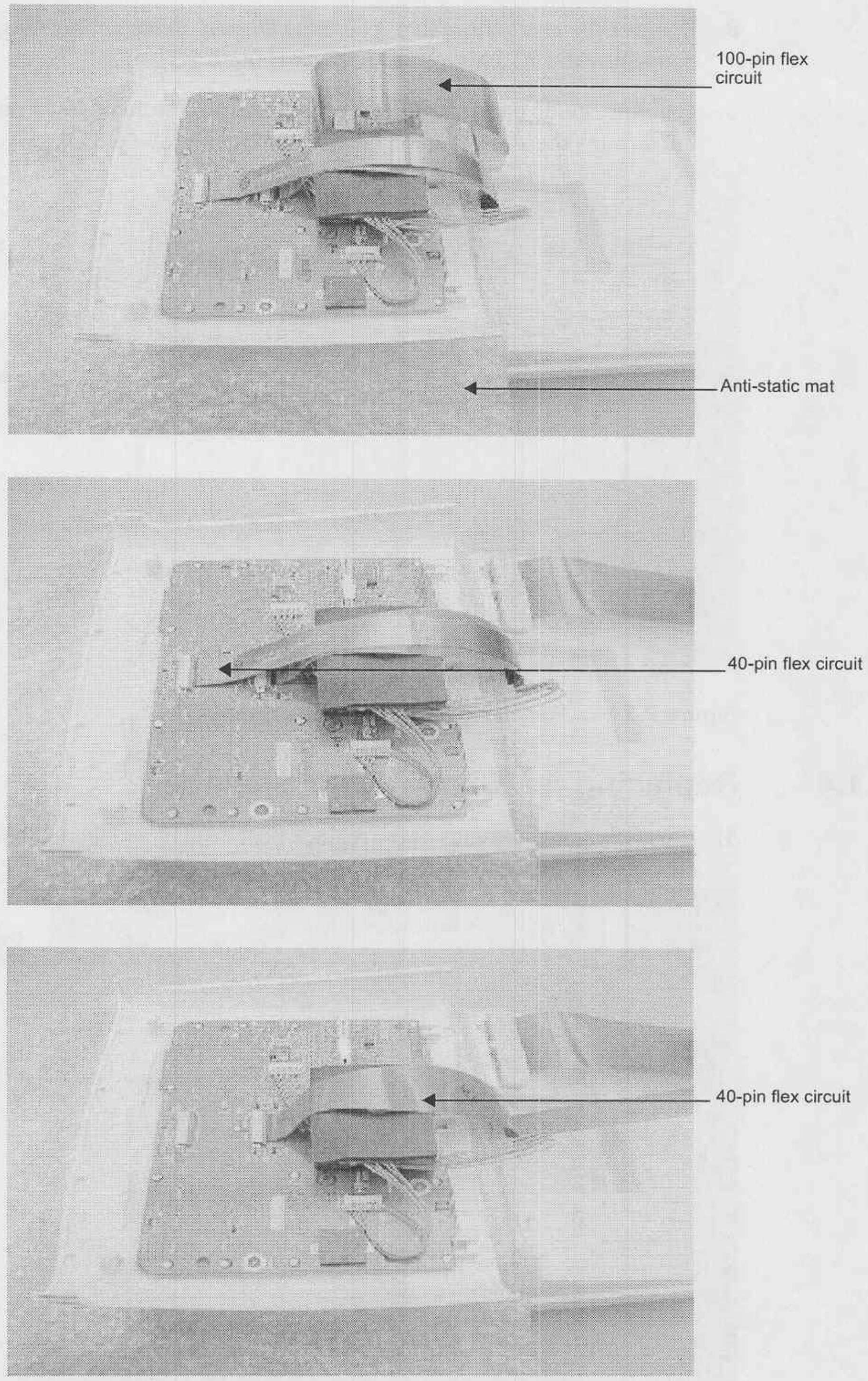

100-pin flex circuit
Anti-static mat
40-pin flex circuit
40-pin flex circuit

Figure 7.2 Disconnecting the Display Wire Harness and Flex Circuits

8. Remove the four screws that secure the Display Subassembly hinges to the top housing with a #1 Phillips screwdriver (Figure 7.3).
9. Carefully guide the ends of the display wire harness and two 40-pin flex circuits out through the slot in the top housing and remove the old Display Subassembly.

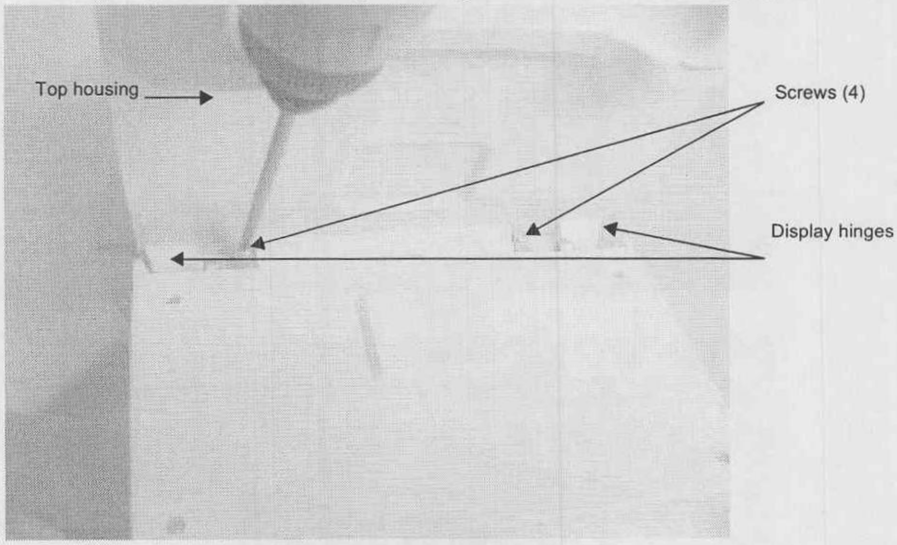

Top housing
Screws (4)
Display hinges

Figure 7.3 Removing the Display Subassembly

7.1.4 Replacing the Display Subassembly

1. Carefully guide the ends of the replacement display wire harness and two 40-pin flex circuits through the slot in the top housing (Figure 7.4).

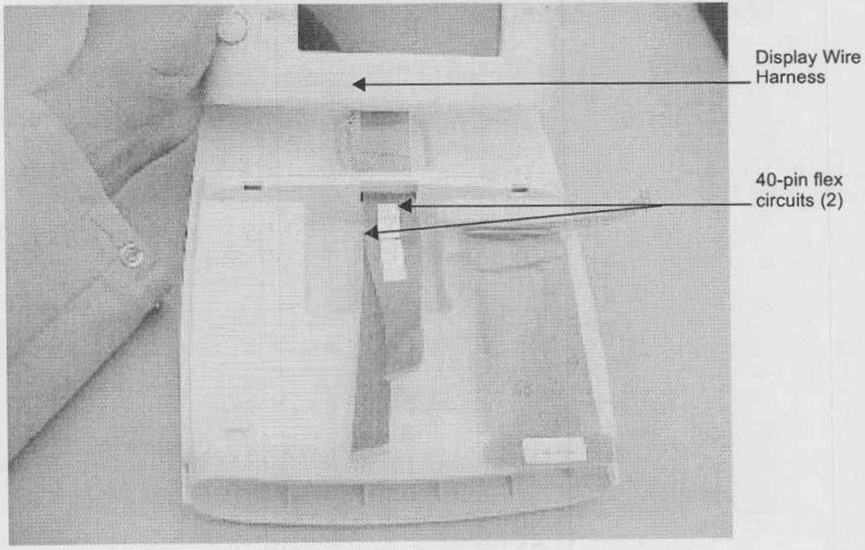

Display Wire Harness
40-pin flex circuits (2)

Figure 7.4 Replacing the Top Housing

2. Secure the four screws on the replacement Display Subassembly hinges to the top housing with a #1 Phillips screwdriver (Figure 7.3). Torque screws to 6.1 in./lb. (0.7 newton meter).
3. Place the Control Panel Subassembly onto the Display Subassembly.
4. Install the display wire harness and flex circuits.

Note: Check that the reference designators on the flex circuits match the reference designators on the PCBA connectors.

5. Replace the 100-pin flex circuit on the bottom module (Figure 7.5).

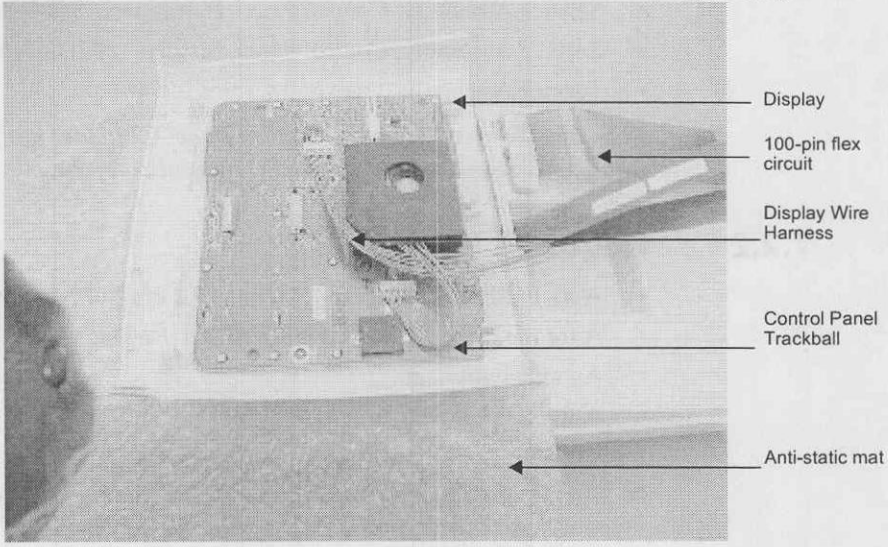


Figure 7.5 Placing the Control Panel Subassembly onto the Display

6. Carefully replace the Control Panel Subassembly by inserting the tabs on the top of the Control Panel Subassembly into the slots.
7. Set the Control Panel into place and replace the two screws inside the battery compartment (Figure 7.6). Torque screws to 7.1 in./lb. (0.8 newton meter).
8. Place the battery in the battery compartment.
9. Turn on the system.
10. Perform the Display tests in **Chapter 8, *Performance Tests,*** on page 67 to verify that the Display Subassembly is functioning properly.

7.2 Control Panel Subassembly Replacement

7.2.1 Required Parts

- Service Assembly, Control Panel C1.9, English (P02082), or
- Service Assembly, Control Panel, French (P02083), or
- Service Assembly, Control Panel, German (P02084), or
- Service Assembly, Control Panel, Italian (P02085), or
- Service Assembly, Control Panel, Portuguese (P02086), or
- Service Assembly, Control Panel, Spanish (P02087), or
- Service Assembly, Trackball C1.9 (P02088)

Note: The Service Assembly, Control Panel C1.9 does not include a trackball. To install a trackball, see Section 7.3, Trackball, on page 54.

7.2.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb (0.2–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

CAUTION:

➤ Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. Initial ESD symptoms may be slightly degraded performance or image quality.

7.2.3 Removing the Control Panel Subassembly

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Remove the two screws in the battery compartment with a #1 Phillips screwdriver; this releases the Control Panel Subassembly from the top housing (Figure 7.6).

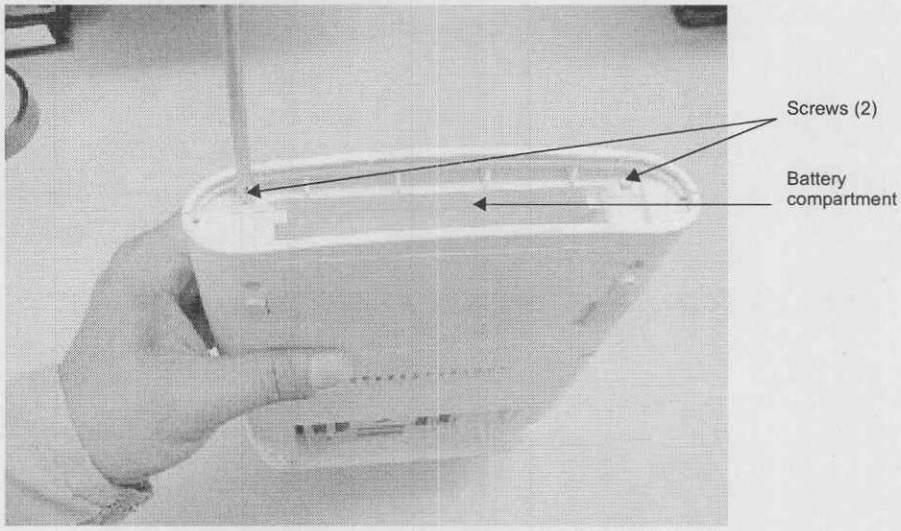


Figure 7.6 Removing the Control Panel Subassembly

3. Insert an anti-static mat between the Control Panel Subassembly and the Display Subassembly to prevent damaging the Display LCD.
4. Carefully lay the Control Panel Subassembly over onto the display to expose the display wire harness and the two 40-pin flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the display wire harness and the two 40-pin flex circuits from the Control Panel Subassembly (Figure 7.7).
7. Remove the Control Panel Subassembly.

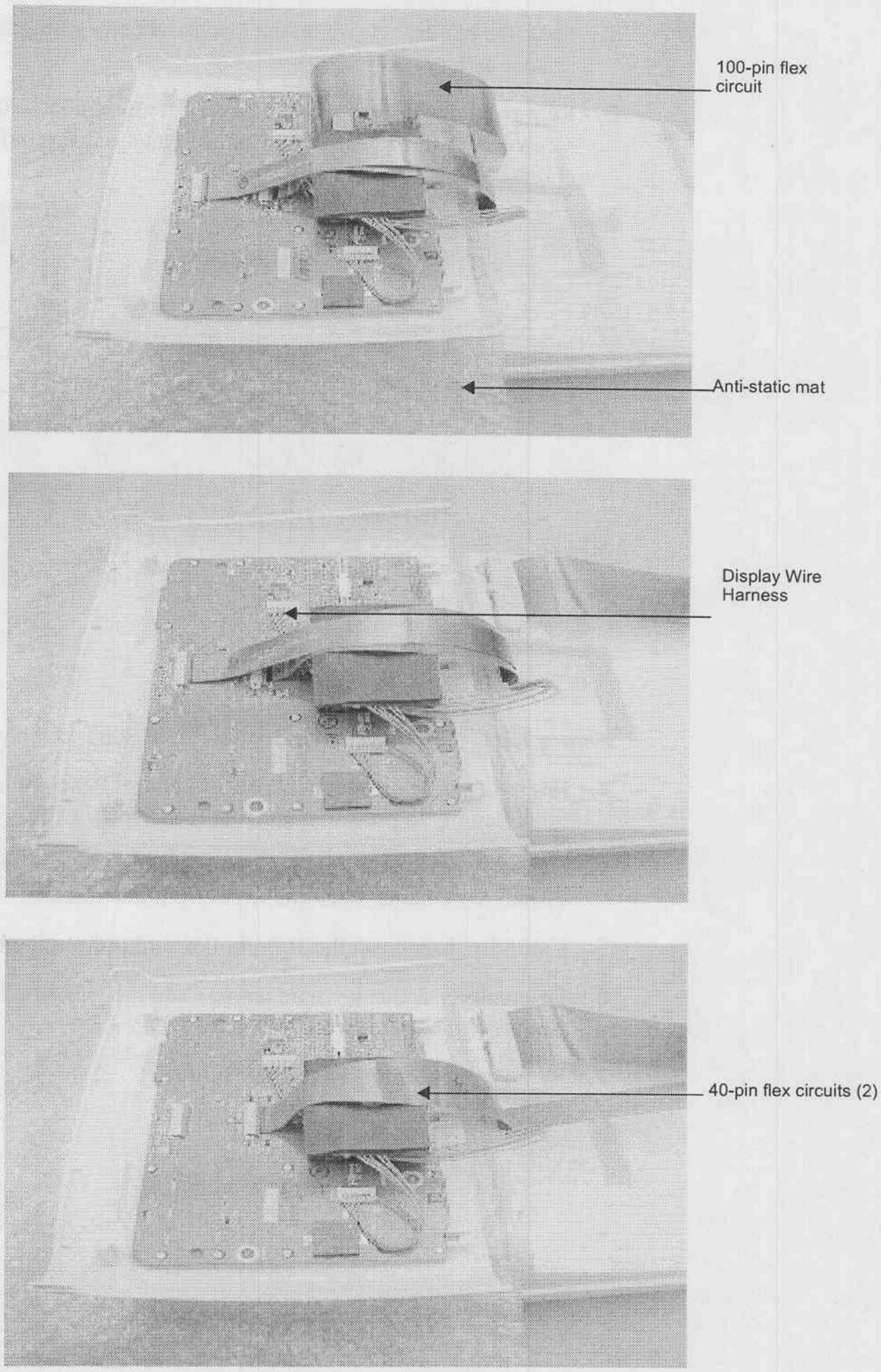

100-pin flex circuit
Anti-static mat
Display Wire Harness
40-pin flex circuits (2)

Figure 7.7 Disconnecting the Control Panel Subassembly

7.2.4 Replacing the Control Panel Subassembly

1. Place the Control Panel Subassembly onto the Display Subassembly.
2. Install the wire harness and the two 40-pin flex circuits.
3. Replace the 100-pin flex circuit on the bottom module (Figure 7.7).
4. Carefully replace the Control Panel Subassembly by inserting the tabs on the top of the assembly into the slots.
5. Set the Control Panel Subassembly in place; replace the two screws inside the battery compartment using a #1 Phillips screwdriver. Torque the screws to 7.1 in./lb. (0.8 newton meter) (Figure 7.8).

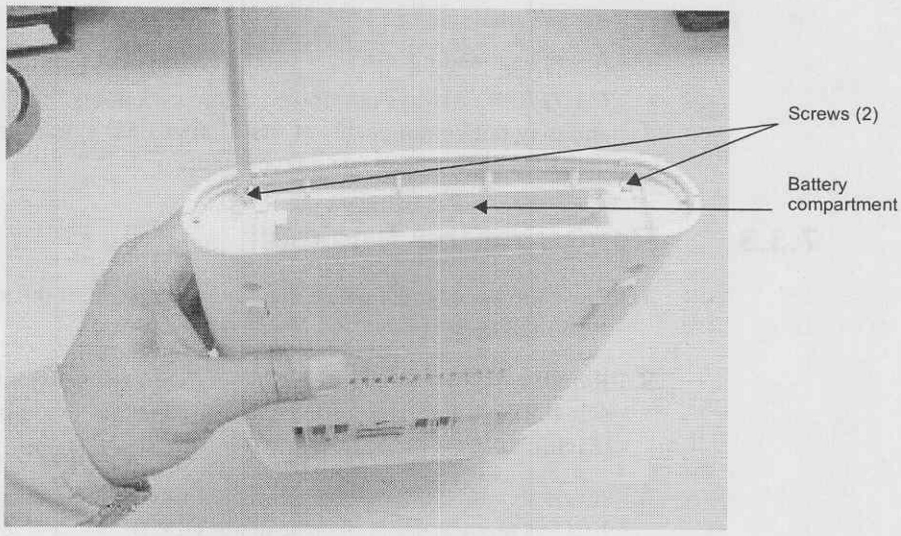


Figure 7.8 Replacing the Control Panel Subassembly

6. Place the battery in the battery compartment.
7. Turn on the system.
8. To verify proper operation of the new Control Panel Subassembly, perform the Control Panel tests in **Chapter 8, *Performance Tests,*** on page 67.

7.3 Trackball

7.3.1 Required Parts

Service Assembly, Trackball, C1.9 (P02088)

7.3.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb (0.2–1.1 newton meter)
- A small, blunt punch
- An anti-static mat
- A wrist grounding strap
- ***CAUTION:*** Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. Initial ESD symptoms may be slightly degraded performance or image quality.

7.3.3 Removing the Trackball

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Remove the two screws in the battery compartment using a #1 Phillips screwdriver; this releases the Control Panel Subassembly from the top housing (Figure 7.8).
3. Insert an anti-static mat between the Control Panel Subassembly and the display LCD to prevent damaging the display LCD.
4. Lay the Control Panel Subassembly over onto the display LCD to expose the wire harness and flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the display wire harness and the two 40-pin flex circuits from the Control Panel Subassembly.
7. Remove the Control Panel Subassembly.
8. Remove the trackball retaining ring. Carefully insert the tip of a blunt punch into the indent and turn the trackball retaining ring slightly counterclockwise. This releases the ring and allows you to remove it (Figure 7.9).

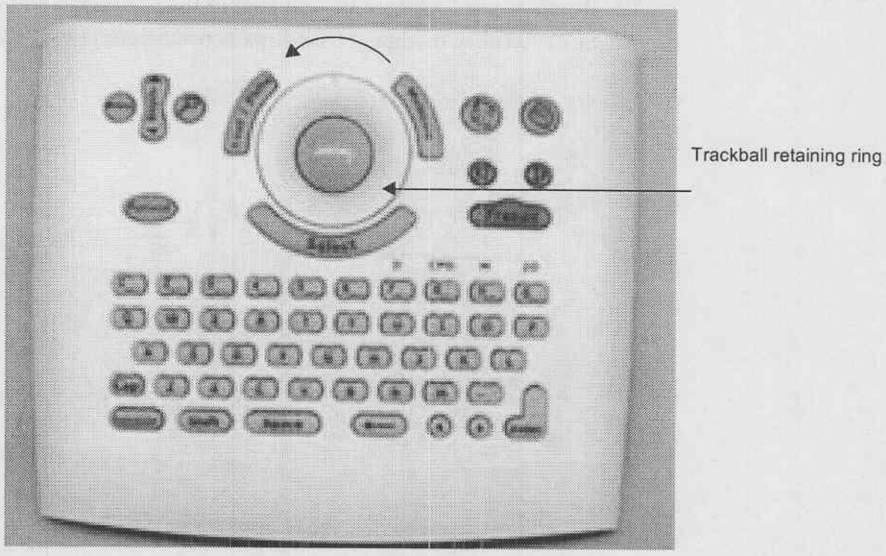


Figure 7.9 Removing the Trackball Retaining Ring

9. Remove the ball.
10. Disconnect the trackball wire harness from the Control Panel Subassembly.
11. Remove the foam backing from the Trackball to expose the four screws connecting the Trackball to the Control Panel Subassembly (Figure 7.10).

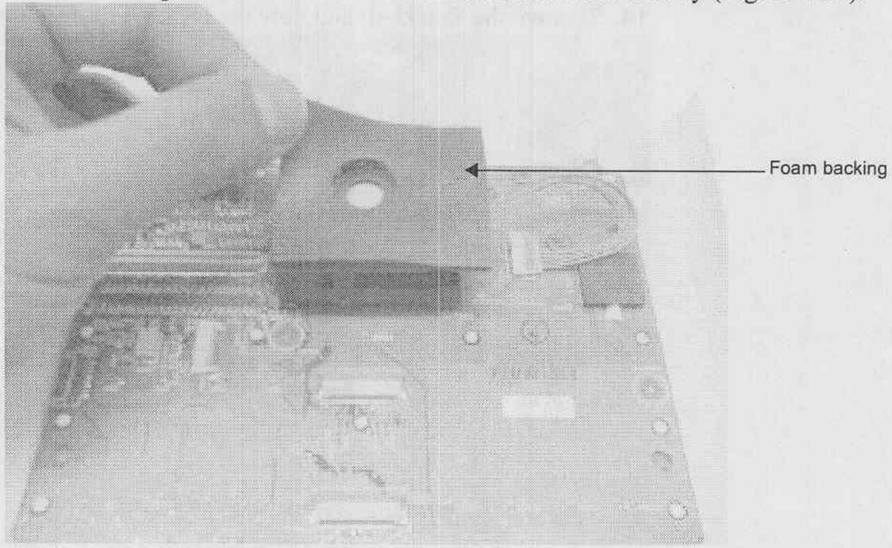


Figure 7.10 Removing the Foam Backing

12. Remove the four screws that secure the Trackball to the Control Panel Subassembly using a #1 Phillips screwdriver (Figure 7.11).

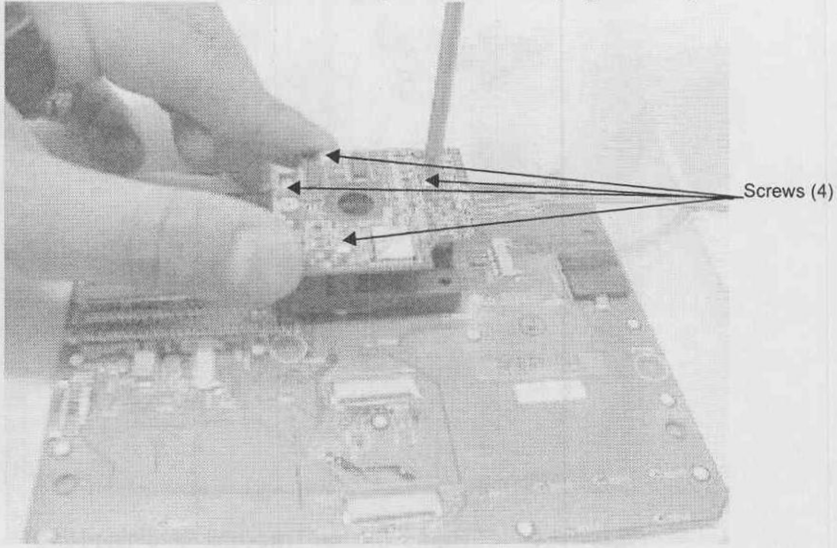


Figure 7.11 Removing the Trackball

13. Holding the Trackball in place, carefully turn the Control Panel Subassembly over and allow the Trackball to drop off of the Control Panel Subassembly, to prevent losing the Trackball parts (Figure 7.12).

14. Remove the Trackball and note the location of its components.

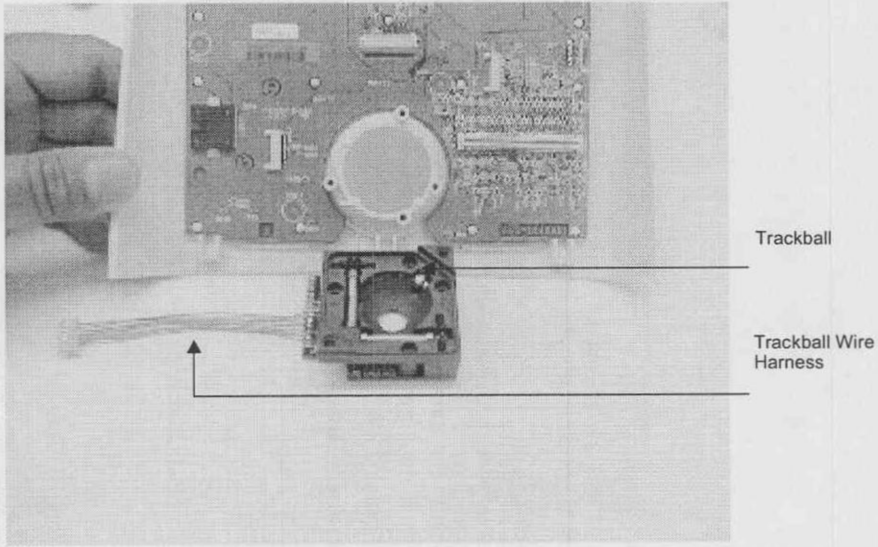


Figure 7.12 Removing the Trackball

7.3.4 Replacing the Trackball

1. Remove the four screws that hold the top cover on the new Trackball using a #1 Phillips screwdriver. Discard the cover and screws. Be careful not to tip the Trackball and spill the Trackball parts (Figure 7.12).
2. Holding the Trackball, carefully turn the Control Panel Subassembly over onto the new Trackball and set it in place.
3. Carefully turn the Control Panel Subassembly over, holding the Trackball in place.
4. Tighten the four screws securing the Trackball using a #1 Phillips screwdriver (Figure 7.13). Torque the screws to 3.6 in./lb. (0.4 newton meter).

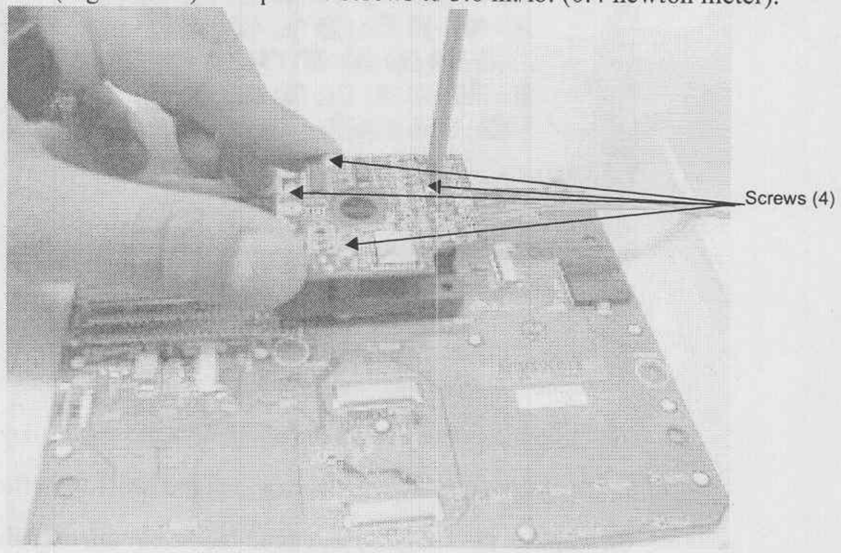


Figure 7.13 Securing the Trackball

5. Place the foam backing on the Trackball (Figure 7.14).

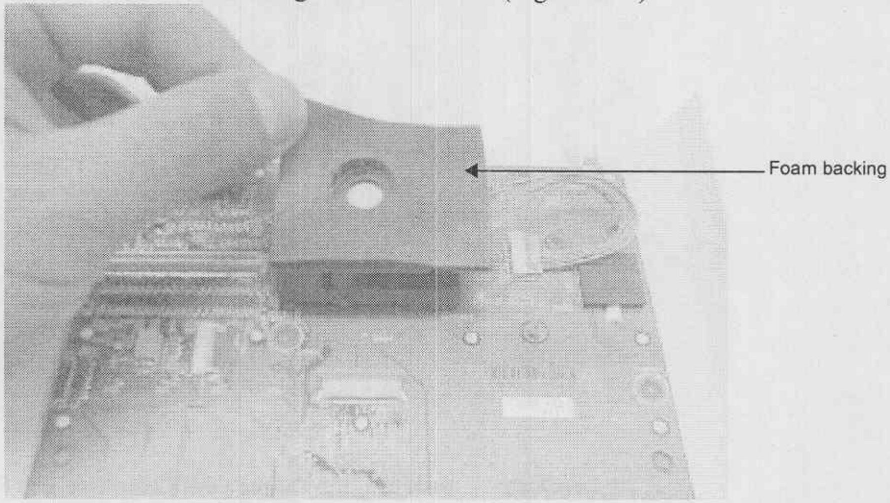


Figure 7.14 Placing the Foam Backing

6. Turn the Control Panel Subassembly over and install the new trackball retaining ring. With your fingers, press and turn the ring slightly clockwise until it locks in place (Figure 7.15).

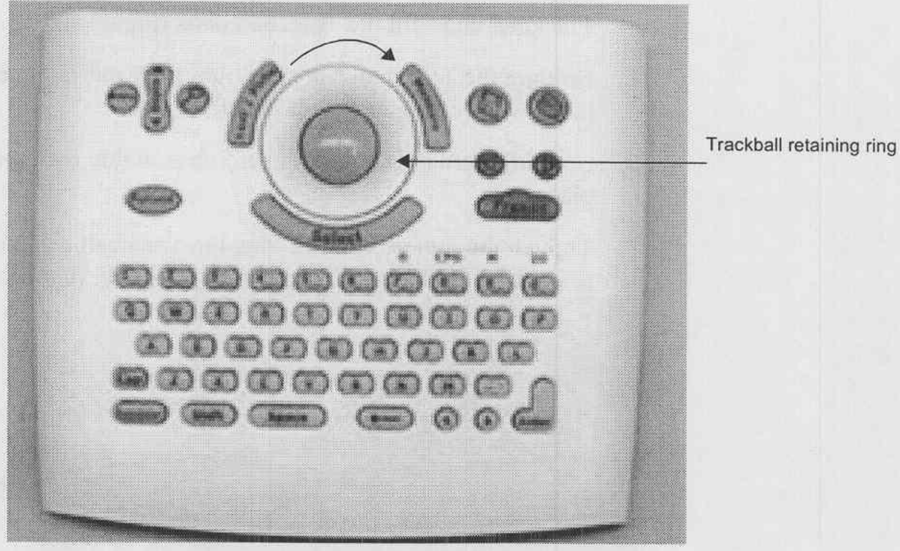


Figure 7.15 Installing the Trackball Retaining Ring

7. Turn the Control Panel Subassembly over and secure the trackball wire harness to the Control Panel Subassembly.

8. Place the Control Panel Subassembly onto the display LCD.

9. Install the display wire harness and the two 40-pin flex circuits (Figure 7.16).

10. Replace the 100-pin flex circuit on the bottom module.

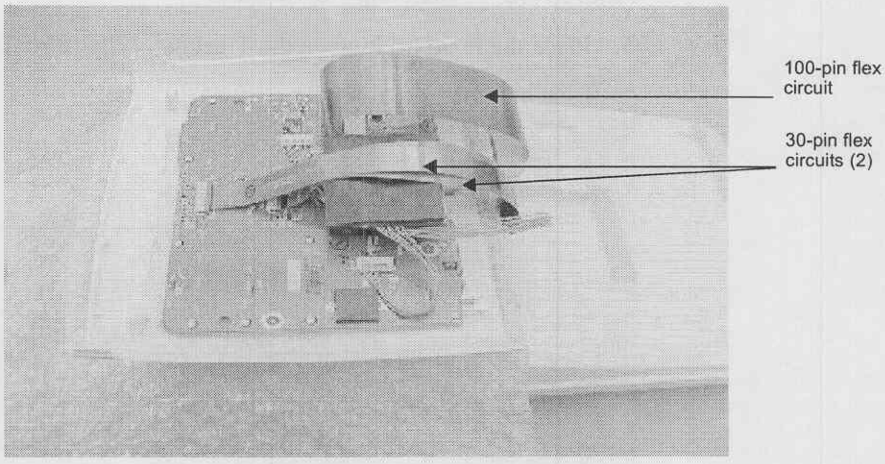


Figure 7.16 Installing the Display Wire Harness and Flex Circuits

11. Carefully replace the Control Panel Subassembly by inserting the tabs on the top of the Control Panel Subassembly into the slots.

12. Set the Control Panel Subassembly in place and replace the two screws inside the battery compartment (Figure 7.17). Torque the screws to 7.1 in./lb. (0.8 newton meter).

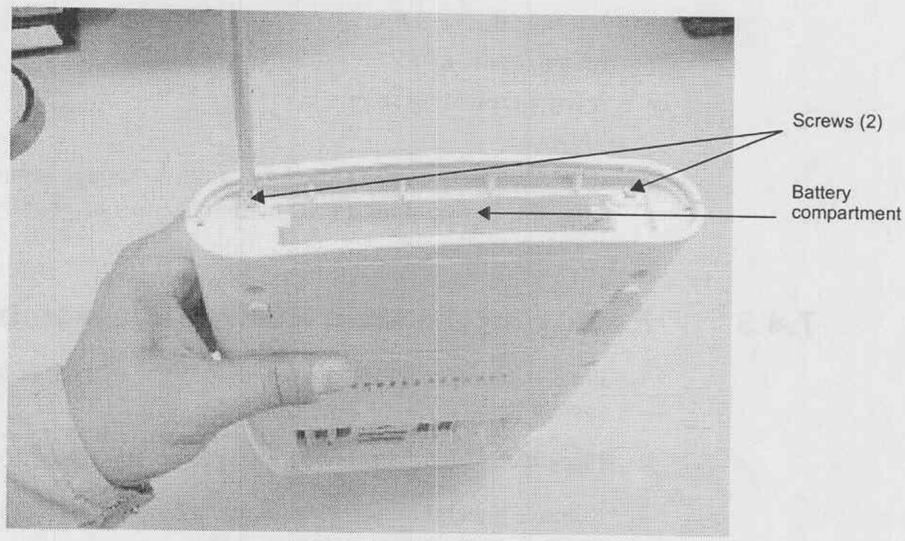


Figure 7.17 Replacing the Control Panel

13. Place the battery in the battery compartment.

14. Turn on the system.

15. Perform the trackball tests in **Chapter 8, *Performance Tests,*** on page 67 to verify proper operation of the new trackball.

7.4 Main PCBA Subassembly Replacement

7.4.1 Required Parts

- Service Assembly, PCB C1.9 Main, English (P02075), or
- Service Assembly, PCB C1.9 Main, French (P02076), or
- Service Assembly, PCB C1.9 Main, German (P02077), or
- Service Assembly, PCB C1.9 Main, Italian (P02078), or
- Service Assembly, PCB C1.9 Main, Portuguese (P02079), or
- Service Assembly, PCB C1.9 Main, Spanish (P02080)

7.4.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 3.6 in./lb (0.4 newton meter)
- An anti-static mat
- A wrist grounding strap

CAUTION:

➤ Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. Initial ESD symptoms may be slightly degraded performance or image quality.

7.4.3 Removing the Main PCBA Subassembly

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Place the system face down.
3. Remove the eight screws securing the bottom housing to the top housing using a #1 Phillips screwdriver (Figure 7.18).

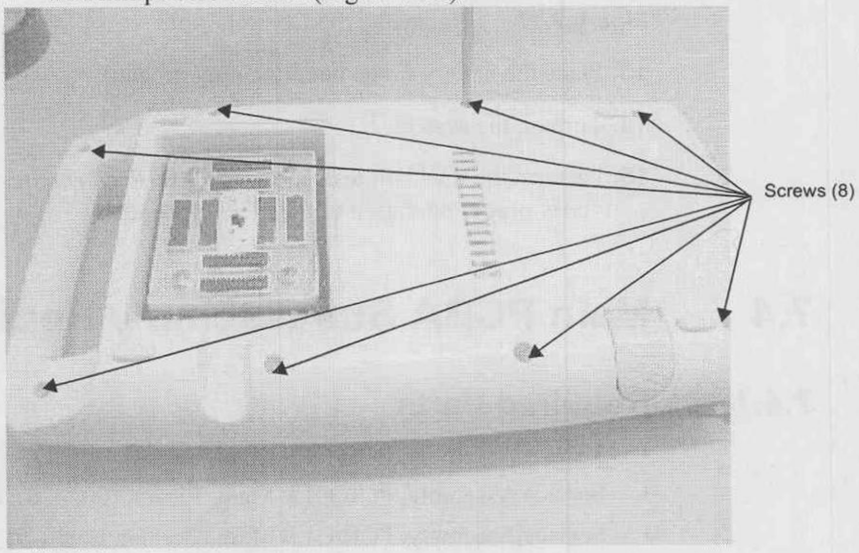


Figure 7.18 Removing the Bottom Housing from the Top Housing

4. Carefully separate the bottom housing from the top housing; do not damage the 100-pin flex circuit that connects the two.
5. Disconnect the 100-pin flex circuit from the Main PCBA Subassembly.
6. Remove the bottom housing that holds the Main PCBA Subassembly.

7. Remove the four screws that connect the Main PCBA Subassembly to the bottom housing using a #1 Phillips screwdriver (Figure 7.19).

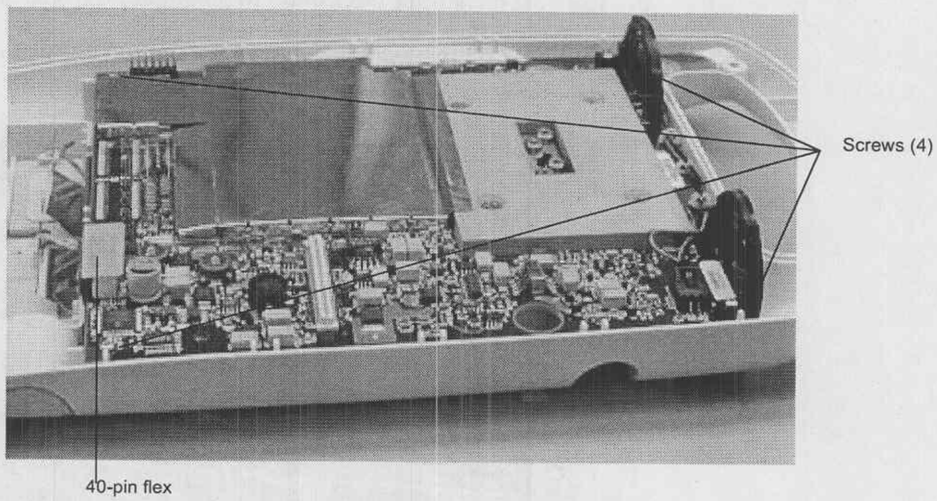


Figure 7.19 Removing the Main PCBA Subassembly from the Bottom Housing

8. Carefully disconnect the 40-pin flex circuit that connects the Main PCBA Subassembly to the Dock Interface PCBA (located under the Main PCBA).
9. Remove the Main PCBA Subassembly.

7.4.4 Replacing the Main PCBA Subassembly

1. Set the replacement Main PCBA Subassembly onto the bottom housing

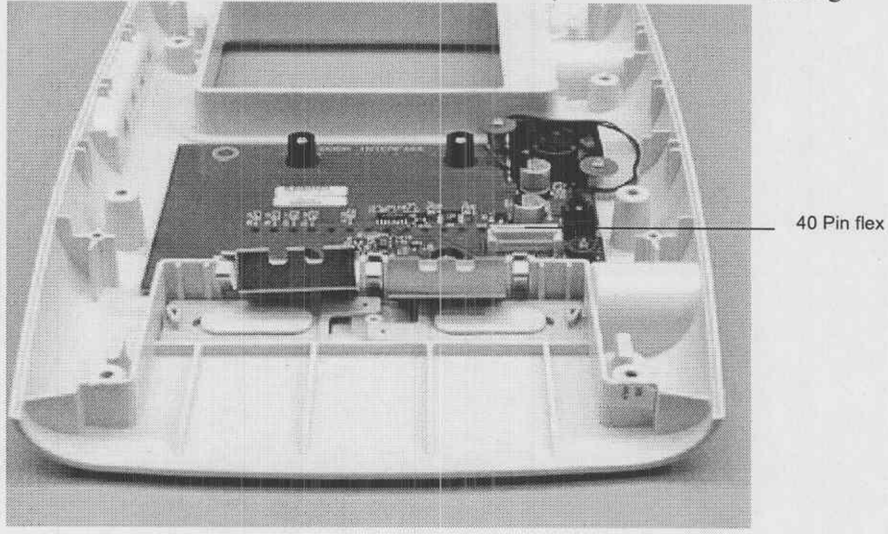


Figure 7.20 Replacing the Main PCBA Subassembly

2. Secure the four screws that connect the Main PCBA Subassembly to the bottom housing (Figure 7.21). Torque the screws to 3.6 in./lb. (0.4 newton meter).

3. Connect the 40-pin flex circuit to the Main PCBA Subassembly.
4. Carefully set the top housing onto the bottom housing, connecting the 100-pin flex circuit as it moves into position (Figure 7.22).

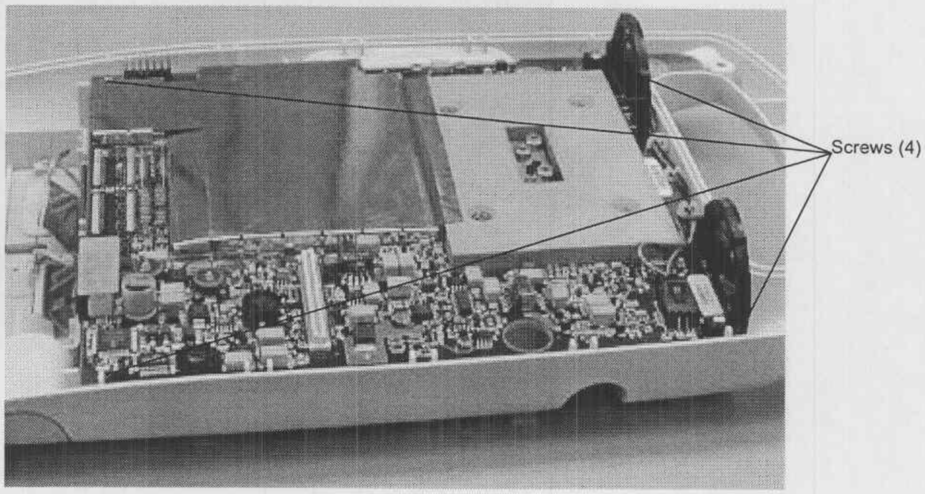


Figure 7.21 Securing the Main PCBA to the Bottom Housing

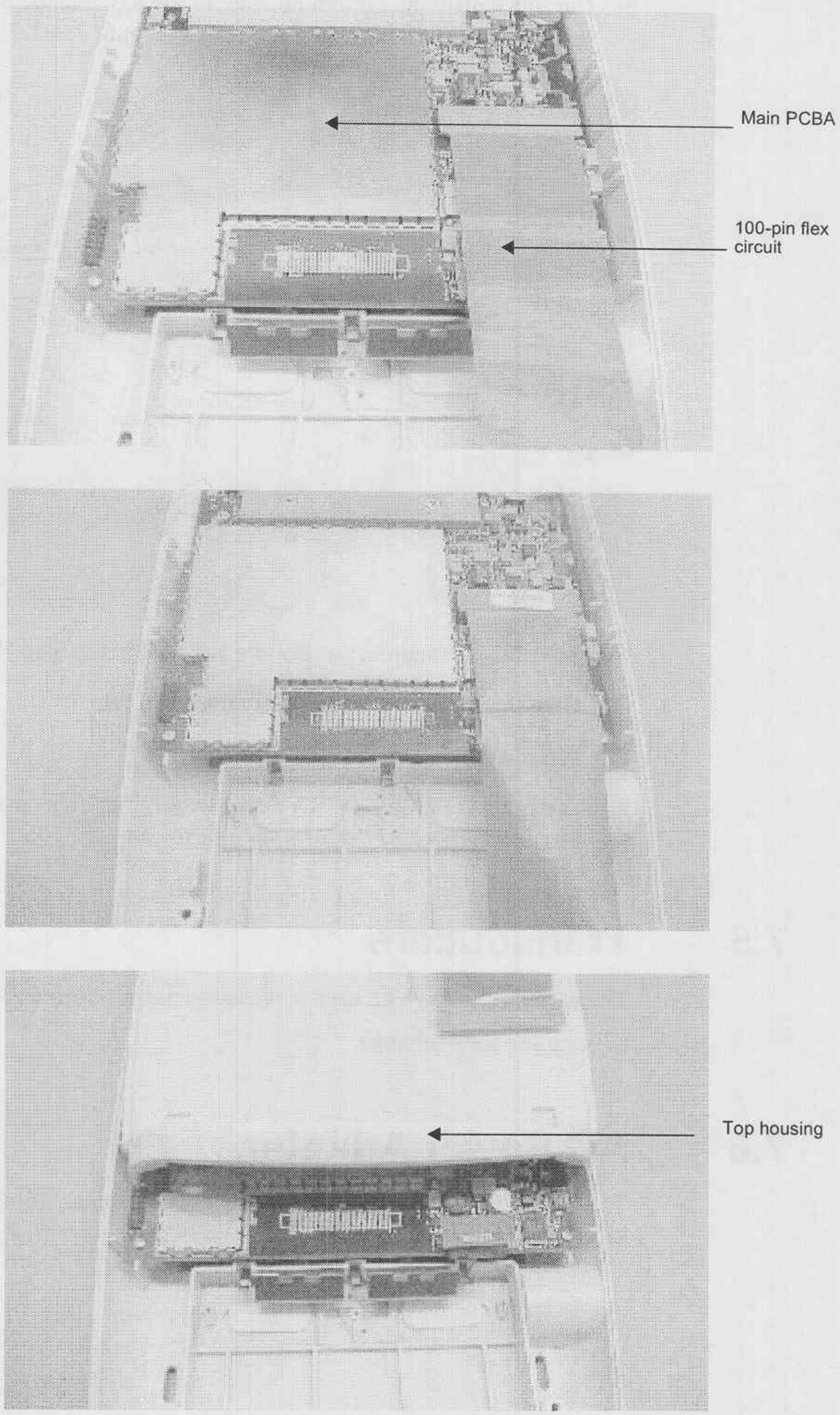

Main PCBA
100-pin flex circuit
Top housing

Figure 7.22 Setting the Top Housing Onto the Bottom Housing

5. Carefully mate the bottom housing to the top housing and secure the eight screws using a #1 Phillips screwdriver (Figure 7.23). Torque the screws to 7.1 in./lb. (0.8 newton meter).

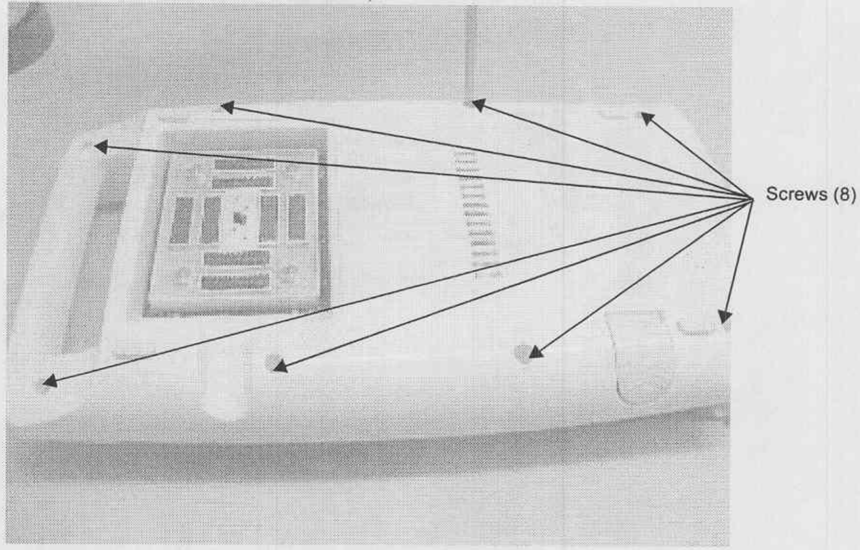


Figure 7.23 Securing the Bottom Housing to the Top Housing

6. Place the battery into the battery compartment.
7. Turn on the system.
8. Verify that the Main PCBA Subassembly functions properly by performing the tests in **Chapter 8,** ***Performance Tests,*** on page 67.

7.5 Transducers

The transducers have no user-serviceable parts; return transducers to SonoSite for exchange.

7.6 AC Power Adapter

The AC power adapter has no user-serviceable parts. Return power adapters to SonoSite for exchange.

7.7 OEM Peripherals

If you need assistance to locate a nearby service center, contact SonoSite technical support.

7.7.1 External Monitor (Sony)

To return a failed display, contact the Sony Service Center at 714-220-9100. For service, ship the display to the original OEM or send Sony displays to the following address:

Sony Service Center
10833 Valley View
Cypress, CA 90630
United States

7.7.2 VCR (Sony)

To return a failed VCR, contact the Sony Service Center at 800-282-2848 or 972-931-2497. For service, ship the VCR to the original OEM or send Sony VCRs to the following address:

Sony Electronics, Inc.
7517 Campbell Road
Dallas, TX 75248
United States

7.7.3 Printer (Sony)

To return a failed printer, contact the Sony Service Center at 770-263-9888. For service, ship the printer to the original OEM or send Sony printers to the following address:

Sony Service
3175 A Northwood Parkway
Norcross, GA 90071
United States

This page intentionally left blank.

CHAPTER 8 Performance Tests

8.1 Overview

WARNING:

➤ **Critical Test Function -** A failure of the system functions tested in this section could affect safety or effectiveness of the system adversely. While performing the steps in this section, verify that the images on the system display and on the external monitor are acceptable.

- Verify that all controls operate smoothly over their full range and that the system responds properly.
- To obtain 2D images, SonoSite recommends using the RMI 413A Soft Tissue Phantom or, the RMI 403 GS Multipurpose Phantom. Any equivalent Phantom is acceptable.
- To obtain Power Doppler images, SonoSite recommends using the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom. Any equivalent Phantom is acceptable.
- When making penetration measurements on a phantom, apply the phantom reference value and tolerance to the measurement.

8.2 Test Equipment:

- SonoSite ultrasound system with a C60/5-2 MHz transducer and an L38/10-5 MHz transducer
- RMI 413A Soft Tissue Phantom, RMI 403 GS Multipurpose Phantom, or the equivalent
- RMI 425 Doppler Phantom, RMI 1425A Doppler Phantom, or the equivalent
- ECG Simulator
- Video Printer
- External Monitor
- Acoustic gel

8.3 Setting Up Performance Tests

To set up the performance tests:

1. Attach the C-60/5-2 MHz transducer to the system.
2. Select **general** for optimization and **OB** for exam type.
3. Couple the transducer to the phantom, adjusting gain settings and transducer for a proper phantom image (e.g., pins are high-level echoes positioned in straight lines; cysts are sonolucent, edges are sharp, and graphite particles of the phantom are mid-grays).

8.3.1 Scan Reference Orientation

1. Verify that the correct transducer name appears in the upper right corner of the system display.
2. Verify that the scan plane orientation mark in the image located near the skinline corresponds to element #1 on the transducer. To test, put your finger on the probe and run it across the transducer face. Your finger touching the transducer face should appear at the orientation mark on the display image format.
3. With the array pointing down and the orientation mark to the operator's left, element #1 corresponds with the left side of the array.

8.4 Testing 2D Performance

To test 2D performance:

1. Use a C60/5-2 MHz transducer in 2D mode.
2. Adjust the position of the C60/5-2 MHz transducer on the phantom.
3. Use the 2D system controls to obtain a clear image that shows both the horizontal and vertical rows of pins.

8.4.1 2D Image Quality

To test 2D image quality:

1. Verify that the ultrasound image appears uniform in both the axial and lateral direction, with no dropouts or intensity variations.
2. Verify that the cystic structure at the focal zone is clearly differentiated from the surrounding tissue and is echo-free, while solid tissue, with numerous echo sources, appears solid.

8.4.2 Axial Measurement Accuracy

Note: Measurements must be performed while the image is frozen.

To test axial accuracy:

1. Acquire the image.
2. Press **Freeze**.
3. Press **Measure**. Two calipers appear on the image display. A menu appears, on which are listed two **distance** icons, an **ellipse** icon, a **delete** icon, and a **calcs** icon, if applicable. (If the **caliper line** setup is on, then a dotted line connects the two calipers. See the *SonoSite Ultrasound System User Guide*, if necessary.) The first caliper in the menu is active by default.
4. Use the **trackball** to position one of the calipers.
5. Press **Select** to fix the caliper and enable the other caliper.
6. Use the **trackball** to move the other caliper. The results update as you move the caliper, and the measurement is complete when you finish moving the calipers. (Press **Select** to alternate the active caliper, and adjust the measurement with the **trackball**.)
7. To perform another distance measurement on the image, select the other **distance** icon and repeat the preceding steps.
8. Measure the distance, center to center, of two pins that are 5-12 cm apart vertically.
9. Verify that the distance measured is within the tolerance listed in Table 8.1.

8.4.3 Lateral Measurement Accuracy

To test the lateral measurement accuracy:

1. Perform steps 1 through 7 in *Section 8.4.2*.
2. Measure the distance, center to center, of two pins that are 4-10 cm. apart horizontally.
3. Verify that the distance measured is within the tolerance listed in Table 8.1.
4. Press **Freeze** to return the system to live 2D mode.

Table 8.1 System Measurement Accuracy

MEASUREMENTS	TOLERANCE
Axial Distance	+/- 2%
Lateral Distance	+/- 2%

8.4.4 Penetration

To test penetration:

1. Adjust the system controls to obtain a clear image that shows the limits of echo penetration as shown in Table 8.2.
2. Measure from the center of the skinline to the deepest vertical position—where the scatter echoes start to break up and tissue definition is lost.

Table 8.2 Imaging Performance

IMAGING PERFORMANCE	C60	ICT	ICT HF	C15	L38	C11
2D Penetration	11.5 cm	6.0 cm	5.0 cm	19.0 cm	6.0 cm	5.0 cm

8.5 Additional Performance Tests

8.5.1 CPD

To test CPD:

Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.

1. Connect any transducer and set up the system for CPD mode.
2. Acquire the image.
3. Press and release the **8** key for **CPD** mode. A Region of Interest (ROI) box is displayed on top of the grayscale image. (Press the **0** key to return to 2D imaging.)

   To move the CPD image:

   - Use the **trackball** to move the CPD ROI. While you are moving the CPD ROI, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the CPD ROI. (The size of the CPD ROI is fixed. There is no control to change it.)

   To adjust CPD gain:

   - Turn **gain** clockwise to increase the amount of CPD gain. (While in CPD imaging, **near** and **far** affect only the 2D image; they do not affect the CPD image.)
   - Turn **gain** counterclockwise to decrease the amount of CPD gain.

4. Image the vessel using a Doppler phantom. Verify that as the gain controls increase and decrease, Doppler echo intensity increases and decreases to correspond. Verify that no flow exists outside the vessel.
5. Save a CPD image by pressing **Freeze** and then **Save**.

8.5.2 PowerMap DCPD

To test PowerMap DCPD:

Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.

1. Set up the system per section 8.5.1 for CPD mode.
2. Press the **8** key while in **CPD** mode for **PowerMap DCPD**. A Region of Interest (ROI) box is displayed on top of the 2D grayscale. (Press the **0** key to return to 2D imaging.)

   To move the PowerMap DCPD image:

   - Use the **trackball** to move the PowerMap DCPD ROI. While you are moving the PowerMap DCPD ROI, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the PowerMap DCPD ROI. (The size of the PowerMap DCPD image is fixed. There is no control to change it.)

   To adjust PowerMap DCPD gain:

   - Turn **gain** clockwise to increase the amount of PowerMap DCPD gain. (While in PowerMap DCPD imaging, **near** and **far** affect only the 2D image; they do not affect the PowerMap DCPD image.)
   - Turn **gain** counterclockwise to decrease the amount of PowerMap DCPD gain.
3. Image the vessel using a Doppler phantom. Verify that as the gain controls increase and decrease, Doppler echo intensity increases and decreases to correspond. Verify that no flow exists outside the vessel.
4. Save a PowerMap DCPD image by pressing **Freeze** and then **Save**.

8.5.3 M-mode Imaging

1. Attach a C60 transducer and acquire an image.
2. Press the **9** key for the **M-mode** sample line.
3. Position the **M-mode** sample line over the image by moving the **trackball** left or right.
4. Press the **9** key again to turn on **M-mode**.
5. Adjust the sweep speed by pressing the **Menu** key and pressing the sweep speed key from the on-screen menu.
6. Press the **Freeze** key to freeze the image. Press it again to return to live imaging.
7. Press the **0** key again to return to **2D** imaging.

8.5.4 Tissue Harmonic Imaging

1. Attach the C60 transducer and acquire an image.
2. Set the depth to maximum and note the depth at which echo information is lost.
3. Press the **Menu** key.
4. Press the **TH** key on the on-screen menu so it displays TH (on). Tissue Harmonic Imaging in now active.
5. Observe a decrease in dot size and a significant loss in penetration due to the higher frequency. Image resolution increases.
6. Press the **TH** key again to turn off Tissue Harmonic Imaging.

8.5.5 Pulsed Wave (PW) Doppler Imaging

1. Attach the C60 transducer.
2. Press the **7** key for the Doppler sample gate.
3. Press the **7** key again for the Doppler spectral trace.
4. Place a large drop of ultrasound gel on the transducer lens.
5. Gently tap the top of the gel and observe a reflection on the spectral trace and the sound from the speakers.
6. Press the **0** key to return to **2D** imaging.

8.5.6 ECG Monitoring

1. Connect an **ECG Cable** to the **I/O** connector located on the left side of the system.
2. Connect an ECG simulator set for 60 BPM, Normal Sinus Rhythm.
3. Set the ECG amplitude to 0.5 mV and verify the trace stabilizes and shows the appropriate waveform.
4. Set the ECG amplitude to 2.0 mV and verify the trace stabilizes and shows the appropriate waveform.
5. Save an ECG image.

8.5.7 Image Quality Verification Test

To test the image quality:

- Products with replaced subassemblies, or products that have been disassembled otherwise, must undergo an Image Quality Verification Test.
- The Image Quality Verification Test should be performed after completing (successfully) *Section 8.3, Setting Up Performance Tests,* on page 68 and *Section 8.5.1, CPD,* on page 70.
- The test is completed before returning the system to service.
- A certified sonographer must perform the test.

8.5.8 Image Review

Review all saved images and verify that the images are displayed properly.

8.5.9 Printer

To test printer operation:

1. Print two images in rapid succession and verify proper operation.
2. Verify that the print control receptacles on the system and on the stand function correctly.

8.5.10 Battery Charging

To test battery charging operation:

1. Insert a battery into the system.
2. Remove AC power from the system AC power connector.
3. Press and hold the **Power** switch to turn the system on. Allow the battery to discharge. The battery indicator LEDs (to the right of the display) extinguish from top to bottom as the battery discharges.
   Note: The battery may take 1–2 hours to discharge.
4. Re-attach the AC power cord to the AC power connector.
5. Note that the battery indicator LEDs light from bottom to top as the battery charges.
6. If charging is not evident within 30–60 minutes, refer to **Chapter 6, *Troubleshooting,*** on page 35 for troubleshooting procedures.

8.5.11 Video Output

CAUTION:

➤ Use only the recommended video monitor, printer, or VCR when verifying the video output at the video receptacle.

To test the video output:

1. Attach an external video monitor to the video connector using the video cable.
2. Turn on the system power and verify that the video on the external monitor matches the video on the system display.

If the video does not appear similar, or there is no display on the external monitor, refer to **Chapter 6, *Troubleshooting, on page*** 35 for troubleshooting procedures.

8.6 Returning Products to SonoSite

8.6.1 Contacting SonoSite Technical Support

For technical support of any SonoSite product, do one of the following:

- U.S. and Canadian customers, call 1-877-657-8118.
- International customers, call +425-951-1330.
- Connect to SonoSite on the World Wide Web at www.sonosite.com. Select **Products**, then choose **Technical Support**.
- E-mail service@sonosite.com

You will be asked to provide the following information by telephone or e-mail:

- Contact name and phone number
- Product name
- Serial number
- Description of the problem

8.6.2 Shipping Instructions

Please contact SonoSite to get a return material authorization number (RMA). Contact SonoSite before returning any product.

The shipping address for all returned products is:

- SonoSite, Inc.
- Attn: Technical Support RMA ____________
- 21919 30th Drive SE
- Bothell, Washington 98021-3904
- USA

APPENDIX A Parts List

This section contains a list of field-replaceable parts.

A.1 Replacement Parts List

The following tables contain all the replaceable parts for the SonoSite ultrasound system. All quantities are one unless otherwise noted.

A.2 Ordering Replacement Parts

To order parts, contact SonoSite Technical Support as indicated in **Chapter 8.6, *Returning Products to SonoSite,*** on page 74.

A.3 Display

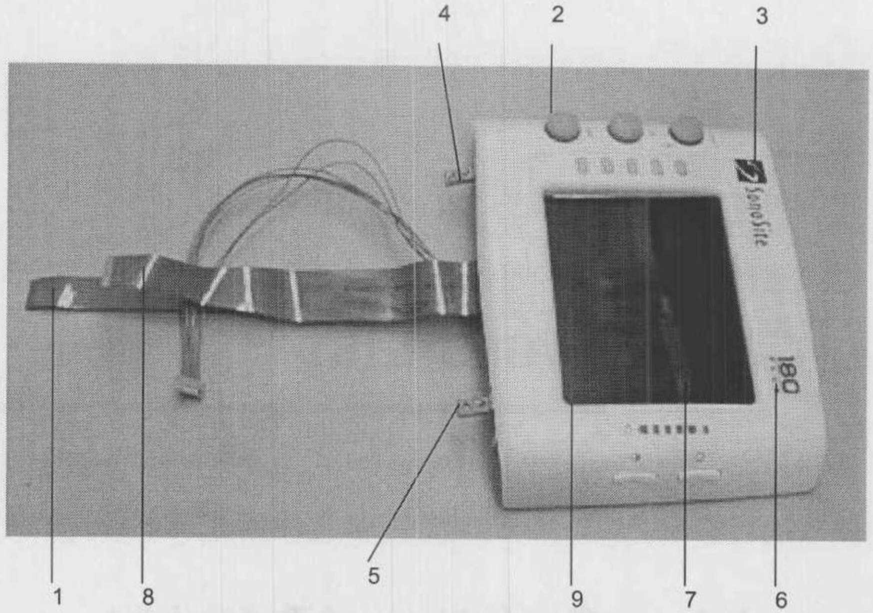


Table A.1 Display

FIND NUMBER	PART NUMBER	DESCRIPTION
	P02081	Service Assembly, Display, SonoSite 180
Note: One of the following labels must be ordered for the display.		
6	P01991	Label “180PLUS”
6	P01992	Label “SonoHeart PLUS”
6	P01993	Label “180 Vet”
Note: The following parts are available for purchase separately.		
1	P00318	Flex circuit, Display, OR
1	P01213	Flex circuit, Display
2	P00806	Knob, TGC Assembly
3	P00457	Label, SonoSite logo
4	P00343	Hinge, Display
5	P00518	Screw, k30x14, cross recess panhead, tf
7	P00340	Lens, display
8	P00611	Assembly, flex circuit, frame
9	P02362	LCD 5”

A.4 Control Panel

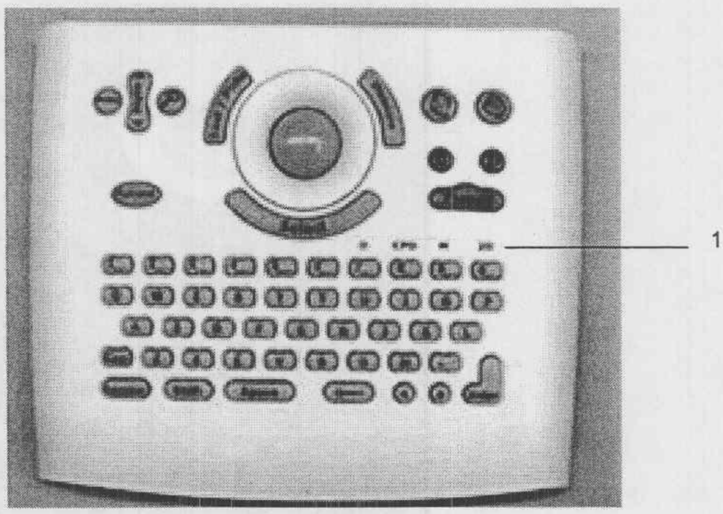


Table A.2 Control Panel

FIND NUMBER	PART NUMBER	DESCRIPTION
	P02082	Service Assembly, Control Panel, English
	P02083	Service Assembly, Control Panel, French
	P02084	Service Assembly, Control Panel, German
	P02085	Service Assembly, Control Panel, Italian
	P02086	Service Assembly, Control Panel, Portuguese
	P02087	Service Assembly, Control Panel, Spanish
1	P01792	Label function keys, English

A.5 Trackball

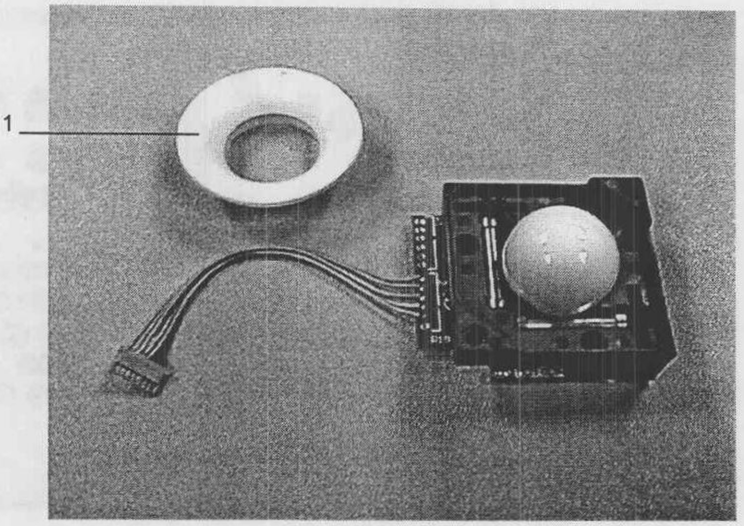
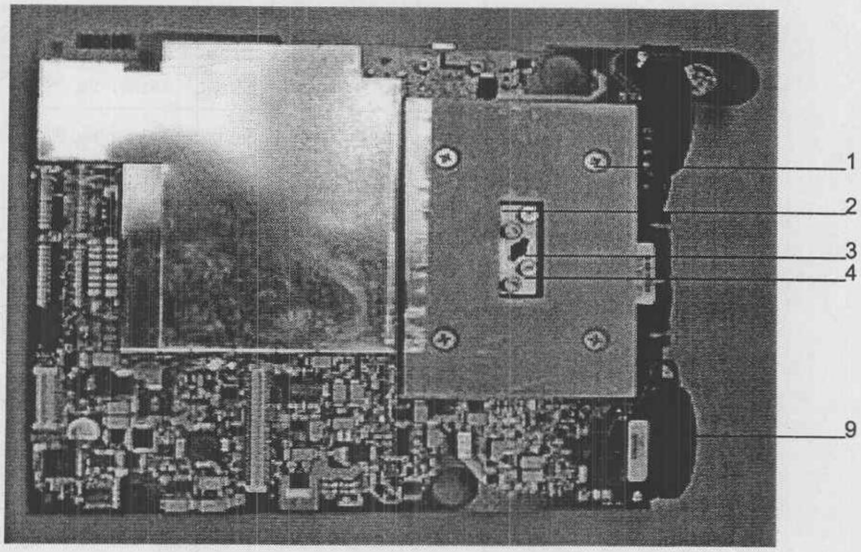


Table A.3 Trackball

FIND NUMBER	PART NUMBER	DESCRIPTION
	P02088	Service Assembly, trackball
Note: The following parts are available for purchase separately.		
1	P00093	Retaining ring
	P00725	Screw, k25x16, cross recess panhead

A.6 Main PCBA

For replacement procedures, see **Chapter 7.4, *Main PCBA Subassembly Replacement,*** on page 59.



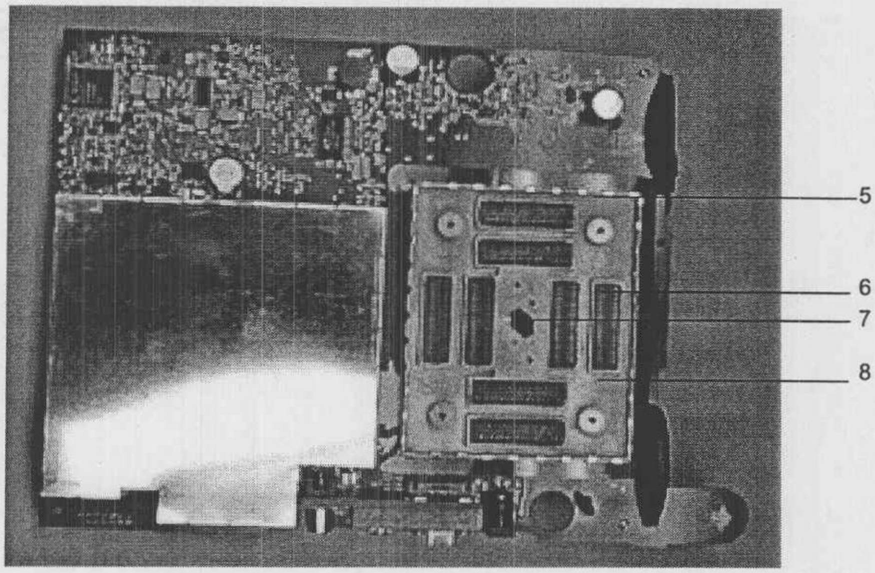


Table A.4 Main PCBA

FIND NUMBER	PART NUMBER	DESCRIPTION
	P02075	Service Assembly, PCB C1.9 Main, English
	P02076	Service Assembly, PCB C1.9 Main, French
	P02077	Service Assembly, PCB C1.9 Main, German
	P02078	Service Assembly, PCB C1.9 Main, Italian
	P02079	Service Assembly, PCB C1.9 Main, Portuguese
	P02080	Service Assembly, PCB C1.9 Main, Spanish
	P00029	Assembly flex circuit, 100-pin (not shown)
1	P00441	Screw, flathead, 6-32, ss, 3/8
2	P00354	Backer plate
3	P00353	Wear plate
4	P00524	Screw, shoulder, thrust plate
5	P00709	Gasket, nest frame
6	P00364	Connector, interposer
7	P00646	Spring, thrust plate,.047 wire
8	P00351	Nest frame assembly, cast
9	P01904	Speaker assembly

A.7 Power Supply and Power Cable

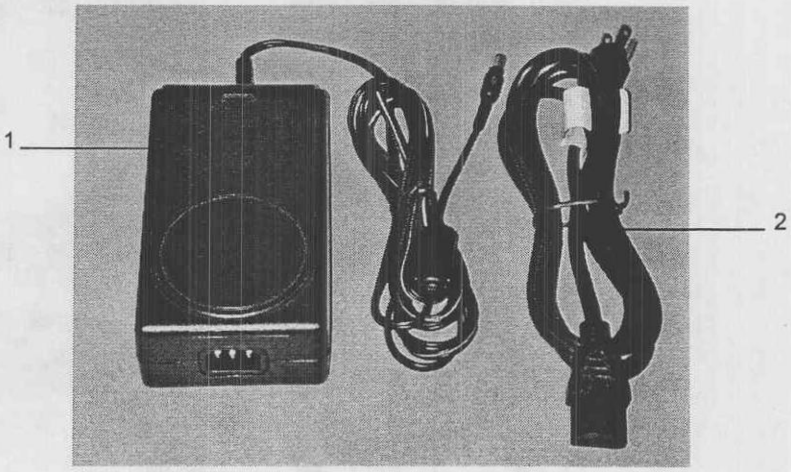


Table A.5 Power Supply and Power Cable

FIND NUMBER	PART NUMBER	DESCRIPTION
1	P00538	Power supply, 85-264 V ac, 50-60 HZ, 16 V, 45 W
2	P00848	Power cable, North America

A.8 Accessory Cables

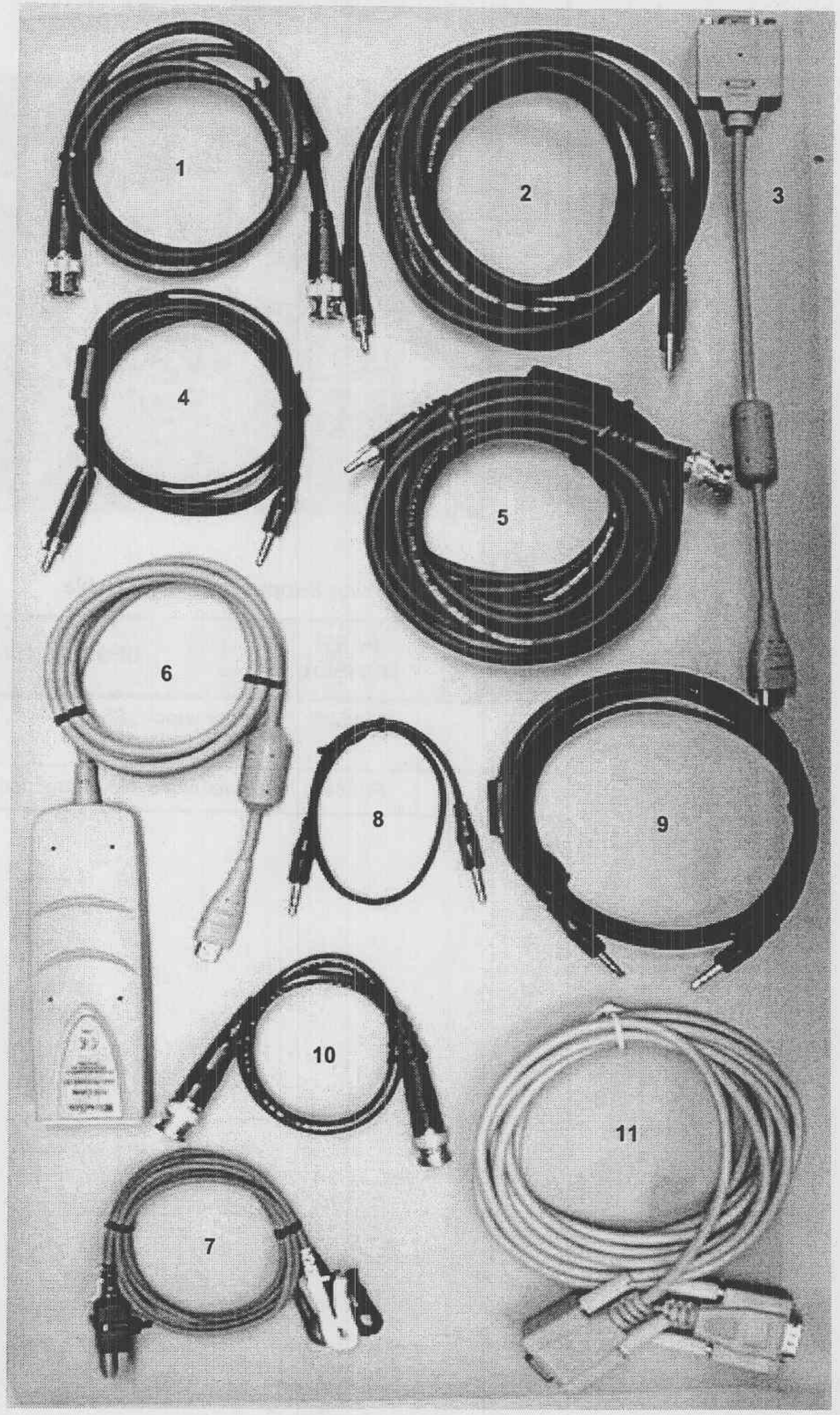

1
2
3
4
5
6
8
9
10
11
7

Table A.6 Accessory Cables

INDEX NUMBER	PART NUMBER	DESCRIPTION
1	P01314	Cable, BNC/BNC video, 3.5 ft.
2	P01111	Cable, RCA/RCA video
3	P02046	Cable, serial, PC Direct
4	P01167	Cable, RCA/stereo
5	P00536	Cable, RCA/BNC video
6	P01592	Cable, ECG
7	P02223	ECG patient lead assembly
8	P0762	Cable, printer control, 1 ft.
9	P00537	Cable, printer, control
10	P0763	Cable, BNC/BNC video, 1 ft.
11	P01568	Cable, serial, null modem

A.9 Additional Spare Parts

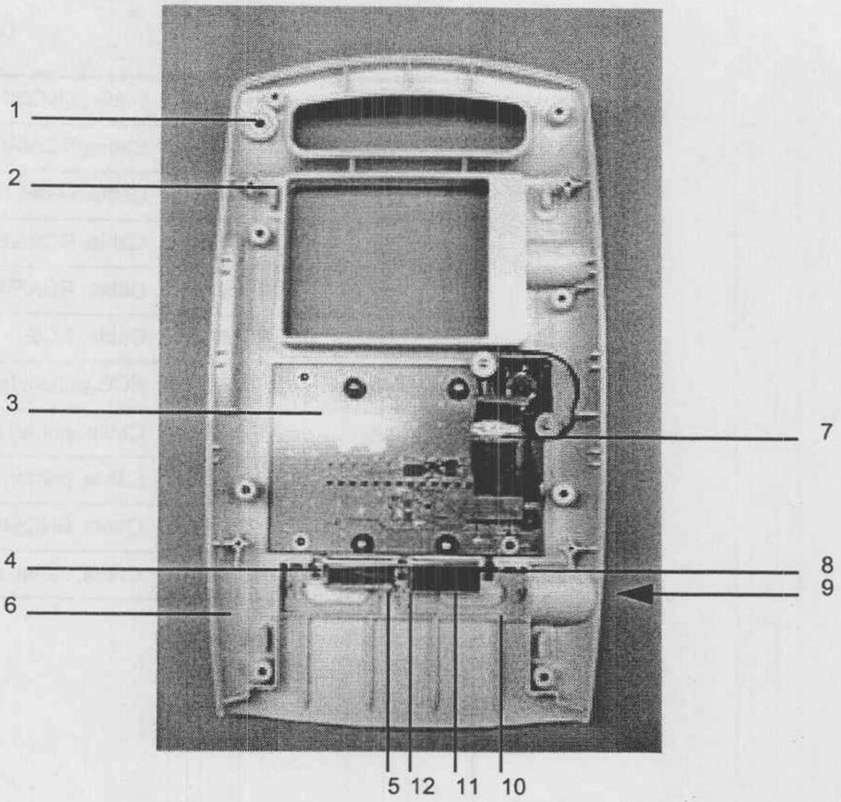


Table A.7 Additional Spare Parts

INDEX NUMBER	PART NUMBER	DESCRIPTION
1	P00104	Key, on/off
2	P00361	Foot
3	P01795	Assembly, PCB, dock interface
4	P00362	Contact, battery clip, x3
5	P00360	Spring, clip
6	P00110	Enclosure, bottom, ui
7	P00301	Assembly, flex circuit 40-pin
8	P00640	Spring, battery ejection, x2
9	P00356	Button, release
10	P00357	Slide, release

Table A.7 Additional Spare Parts, *Continued*

INDEX NUMBER	PART NUMBER	DESCRIPTION
11	P00358	Retainer, slide
12	P00359	Pivot, slide
	P00107	Contact, dock interface clip (not shown)
	P00113	Enclosure, top, UI (not shown)

APPENDIX

B Service Event Report

The Service Event Report provides information about product failures to the manufacturer and to authorized service facilities, which provide approved warranty services for SonoSite products. For all repairs completed, complete the form and return a copy of it to the following address:

SonoSite, Inc.
Technical Support
21919 30th Drive SE
Bothell, Washington 98021-3904

telephone:	1-877-657-8118 (U.S. customers) +425-951-1330 (international customers)
facsimile:	+425-951-6700
e-mail:	service@sonosite.com
website:	www.sonosite.com Select **Products**, then Technical Support.

Service Event Report

SonoSite

Service Provider

Name:	Date:
Company:	
Address:	
Phone Number:	Fax Number:
E-mail address:	

Device Description

Name:	Serial Number:	
Part Number:	Lot Number:	Revision:
Software Version:	Other Identifiers:	

Event Description

Diagnosis

Service Performed

Performed By:	Date:
Actions:	

Parts Removed

Part Name	Part Number	Serial Number	Lot Number	Rev	Replaced By

Parts Installed

Part Name	Part Number	Serial Number	Lot Number	Rev	Replaced By

Tests Performed (attach test data)

Test:	Test:
Performed By:	Performed By:
Result: Pass ☐ Fail ☐	Result: Pass ☐ Fail ☐

Attach additional sheets as required

Page ____ of ____

F00019 Rev B

Index

Numerics

2D imaging 1
2D performance tests
  axial measurement accuracy 69
  image quality 68
  lateral measurement accuracy 69
  penetration 70

A

AC power
  see also power
  using 26
AC power adapter 64
accessories 18
acquisition subsystem 12

B

battery 2
  charge indicators 16
  charging 31
  checking 30
  diagnosis figure 43
  installing 25
  release 15
  safety 8
  specifications 20
  storage and shipping 19
battery charging
  test 73
battery pack
  operating specifications 16
biological safety 9

C

C11/7-4 transducer 1
C15/4-2 transducer 1
C60/5-2 transducer 1
cable 2
cleaning and disinfecting 33–34
  precautions 33
Color Power Doppler
  adjusting gain 70, 71
contaminated materials
  receipt of 33
control panel assembly 50
  removing 51
  replacing 53
  required parts 50
  required tools 50
control subsystem 12
controls
  optimize 15
conventions 2
CPD imaging 1

D

depth 15
diagnosis figures 35
disinfectants
  recommended 34
display
  diagnosis figures 38
  failures 36
display assembly 45
  removing 46
  replacing 48
  required parts 45
  required tools and materials 45
display subsystem 12

E

electrical
  safety 5
  specifications 20
environmental specifications 19
equipment protection 7
error message 7
external power 15
  power supply 17

F

far 15
fetal tables 18

G

gain 15
grace period 3

H

humidity limits 19

I

ICT/7-4 transducer 1
image
  quality verification test 73

- review 73
- storage 19

imaging
- modes specified 19

introduction 1–28

K

keyboard
- diagnosis figure 40

L

L38/10-5 MHz 38-mm 18

L38/10-5 transducer 1

labeling
- symbols 9

license key 3
- installing 28
- obtaining 28

license update screen
- displaying 30

M

main PCBA 59–64
- failures 36
- removing 60
- replacing 61
- required parts 59
- required tools 60

menu controls 15

monitor 18
- brightness 15
- contrast 15
- external diagnosis 39
- specifications 18

moving image 70, 71

N

near 15

P

parts list 75–84
- additional spare parts 84
- control panel assembly 77
- display assembly 76
- main PCBA 79
- trackball assembly 78

patient 15

performance tests 67–74
- overview 67
- peripheral output 73
- printer 73
- required test equipment 67
- video output 73

peripherals 18, 65
- medical grade 2
- non-medical grade 2
- printer 65
- VCR 65

phantoms
- PFS-A-3-1-G2 UHDC Flow System (Doppler) 67
- RMI 1425A Doppler 67
- RMI 403 GS Multipurpose 67
- RMI 413A Soft Tissue 67
- RMI 425 Doppler 67

physical dimensions 18

power
- battery charge indicators 16
- battery pack 15
- connections 17
- external 16
- line cord specifications 17, 18, 31
- subsystem 13
- supply 17
- switch 15
- turning off 25
- turning on 24

power adapter 2

PowerMap DCPD
- imaging 1

printers
- test 73

processing subsystem 12

product failures
- reporting 87

products
- returning 74

R

replacement parts
- list 75
- ordering 75

replacement procedures 45–65

return material authorization number (RMA) 74

S

safety 5–9
- battery 8
- biological 9
- electrical 5
- equipment protection 7
- labeling symbols 9

service event report 87
- form 88

setup and operation 23
shipping
  instructions 74
shipping specifications 19
SiteCharge dual battery charger 2, 64
SiteLink Image Management software 2
SitePack carrying case 2
SiteStand mobile docking station 2
software
  licensing 3
  upgrading 27
SonoSite technical support
  contacting 74
standards
  airborne equipment 21
  electromechanical safety 20
  EMC/EMI 21
storage
  image 19
  specifications 19
Subassembly 46, 60, 61
subassembly
  replacement 35
symbols, labeling 9
system
  charging requirements 16
  components 1
  controls 14
  depth 18
  diagnosis figure 42
  dimensions 18
  height 18
  measurement accuracy 69
  overview 11–21
  software 2
  specifications 18
  temperature limit 19
  turning off 24
  turning on 24
  waking up 25
  weight 18
  width 18
system and subsystem
  diagnosis 35
system information screen
  displaying 30

T

theory of operation 11–13
trackball
  diagnosis figure 41
trackball assembly 54
  removing 54
  replacing 54, 57
  required parts 54
  required tools 54
transducer 18
  acquisition subsystem 11
  C15/4-2 MHz 15mm 18
  C60/5-2 MHz 60mm 18
  connecting 23
  ICT/7-4 MHz 11mm 18
  removing 24
  servicing 64
  specifications 18
troubleshooting 35–43
  failures 36
  test equipment 35

U

universal precautions 33
user interface subsystem 12

V

video
  output tests 73

W

warnings 7

Z

zoom 15